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CHILDREN'S
GARDENS
FOR
PLEASURE
HEALTH
AND
EDUCATION

HENRY G. PARSONS



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CHILDREN'S GARDENS

"A Children's Garden is where children grow vegetables and flowers under the guidance of a person trained to show them Nature's laws in operation, and at the same time show them how to apply the knowledge of these laws in the work and observation of life."

HENRY GRISCOM PARSONS

CHILDREN'S GARDENS

Children's Gardens

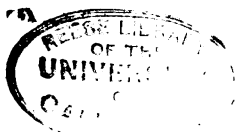
For Pleasure Health and Education

BY

HENRY GRISCOM PARSONS

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ILLUSTRATED



New York

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TO MRS. HENRY PARSONS,
Founder of the First Children's School Farm in New York City
Director of Children's School Farms of the Department of
Parks, New York City
President of the International Children's School Farm
League, New York City
President of Long Acre League, New York City
New York State Granger
Lecturer, Author, Educator, and Mother
In whom the Children's Garden Movement has found
a source of inspiration and vitality
Practical, warm hearted, resourceful and able, with unflinching
courage she has met every difficulty, and shown to the
world the way to bring to children
Happiness, Health and Knowledge
through the Children's Garden
This volume is dedicated by her son,
The Author

205081





Photo by the Author
Children's School Farm, DeWitt Clinton Park, 54th St. and 12th Ave., New York City, 1909

PREFACE

In 1902, Mrs. Henry Parsons started the First Children's School Farm in New York City, on the vacant lots at the foot of West 53rd Street, where to-day is the beautiful DeWitt Clinton Park.

As years went on, she learned of the work of others, and that the use of the garden in the education of children, was begun at least as far back as five hundred years B.C. Many of the ideas and practices which she initiated, found their main difference from that of others in her viewpoint of the purpose of the work; that the garden was to foster the growth of children as its main object, instead of being principally to teach them how to grow plants.

This new viewpoint has vitalized the work, and given it a reason for more general use than it ever had before, and as a result, wherever children are being educated, the possibility of having a garden is now being considered, and in those states and countries where primary education is showing the most advancement, there will be found the largest number of Children's Gardens. During the past few years, they have increased rapidly in number, and from now on, they are destined to play an important part in the education of children.

CHILDREN'S GARDENS

The formation of the Commissions on Country Life, and Conservation of the Nation's Resources, the great campaigns against Tuberculosis, and the Congestion of Population in Cities, and the Inquiry into the reason for the High Cost of living, has aroused a widespread agitation for popular education to meet these questions. As a result legislators are passing laws requiring the teaching of elementary agriculture, to the confusion and consternation of the teachers, who are appalled by the vastness of the subject, their lack of preparation, and the apparent difficulty of fitting the new course into the curriculum for children. The endeavor here has been to suggest working plans which will open the way for them.

In preparing this volume, it seemed wise to adhere to the type of garden in which the ideas and methods to be shown were developed, so as to explain more clearly each step of the work, without confusing the reader with many exceptions and variations of procedure. When the aims and methods are understood, the intelligent worker can then adapt and develop details of procedure to fit local conditions.

A prominent feature of the book is its illustrations, and their chief value lies in the fact that many of them are photographs taken by the author from the actual work or from his drawings and designs.

The book is divided into theory and practice, and in the theory it takes up the values of Children's Gardens, and attempts to show how far reaching such instruction may be in forming the Nation's people,

CHILDREN'S GARDENS

and tells of some of the knowledge now needed and easily acquired through the medium of the garden.

Under the practice, it tells how to prepare and lay out the ground, and how to instruct and control children in gardens of from twenty to five hundred plots. Then, in detail, it takes up each step of the work, and describes how to do it.

The aim throughout is to emphasize two points: that the knowledge and training to be gained is vital, and that it can be made quite simple and delightful.

This book should appeal to all teachers of primary education, in fact, to all who have to do with the care of children; parents, heads of institutions, and physicians. It should also appeal to all novices at gardening, for, while especially for children, it has much in it of value to the adult who is a beginner.

Real estate men will find food for thought in the suggestion that simple garden instruction will help many to better enjoy and be willing to stay in their suburban homes.

Railroad presidents, who are searching for the means to awaken people to a better use of the land, will find in this book perhaps the key to the situation; that a rational treatment of the subject in the school days of all children, will, in a few years, result in the very spirit which they desire.

HENRY GRISCOM PARSONS.

New York, March 1, 1910.

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CHILDREN'S GARDENS



CHILDREN'S GARDENS

CHAPTER I

EDUCATIONAL NEEDS TO RELIEVE POVERTY, SICKNESS AND INEFFICIENCY

Throughout the United States there is the anomalous condition of a country of large natural wealth and great possibilities, on the one hand, and on the other hand, masses of people struggling with poverty and its hardships.

Some sociologists teach the evils of congested cities and urge the poverty-stricken to go into the country and become farmers, while at the same time farmers are complaining of unremunerative labor, unsocial conditions, and their children are flocking to the cities.

For many persons *to be poor in a wealthy country, to be sick in a good climate, to be inefficient among a progressive people*, is a sign of unwise educational methods, not of inability on the part of the people. A very necessary part of their education was omitted. They were not taught to battle with the world or meet life's emergencies.

To lessen the number of *poor, sick, inefficient, and worse*; to teach the general public how to be *happy*,

healthy, and successful, educators must give definite instruction in how to attain these. The instruction must begin with the children before twelve years of age, and must be so vividly imparted as to leave indelible impressions.

To keep well and happy, to do work efficiently, to store up energy, and the products of energy, and make the surplus productive, is what humanity is striving for. It is almost impossible for the adult to change the habits of a lifetime, and learn anew, but with the child, its work and play can be so planned that it will unconsciously absorb the principles and form habits of action that will lead to the acquisition of *health and happiness, thorough and profitable work, economy and thrift.*

The greatest source of wealth that any Nation has at its disposal, lies in its children. The largest item of expense in maintaining and developing a Nation *ought to be* that for primary education. It will give the largest returns.

Instruction must begin with the child *before twelve years of age* to result in action in the man.

Knowledge necessary to maintain life, health, happiness, courage and resourcefulness, should be given throughout all instruction, and also, knowledge necessary for the individual to live as a member of a well-ordered community, and protect that community's wealth and privileges.

CHAPTER II

THE CHILDREN'S GARDEN IS A LABORATORY IN WHICH
TO TEACH HOW WEALTH, HEALTH, COURAGE,
ENERGY (FRESH AIR AND GOOD FOOD)
AND HAPPINESS ARE TO
BE GAINED

The Garden is the place to teach and illustrate some of the knowledge much needed in the education of children. Here Nature shows over and over and over just how she works. Her lessons are truthful, and there is plenty of opportunity to verify them in the endless repetition. The child, as it develops, will watch, absorb the lessons, and apply the knowledge in its own life.

In no other laboratory, perhaps, does the child learn so quickly and so clearly that "knowledge is power." Experience with children has proven the Garden to be a great incentive *to acquire that class of knowledge which will give power* — what the average man terms practical information. That method of education which develops resourcefulness in the individual is worthy of consideration.

In the elementary education there should be simplicity and directness. The laws which control mental, moral and physical welfare are each year becoming

clearer, better defined, and because this is so, social economists are giving more attention to prevention against evil. The greatest preventive measure of all, which is now rapidly assuming vast proportions, is to incorporate in the general scheme of common school education, a simple, direct method of instruction in natural laws, which will result in a public that will give intelligent and effective co-operation in the enactment and fulfillment of laws for the public good.

For a few thousands to take technical, complex courses in universities, resulting in highly trained specialists in Civics, Sanitation, or Morals, is not enough. The public and private schools must produce a general public that will co-operate efficiently. Educators realize this, and are earnestly working to evolve a system of instruction in the schools, which will give this result.

The fascination of the Garden has not yet been shown to the general public, nor the full value of the knowledge to be gained there. To most people it is a place to grow vegetables and flowers to supply physical needs, but to a few it is the theatre of Nature's mysteries, where man can learn control of great forces.

We are indebted to the powers of observation and deduction of a certain engineer for tunnels under water. One day he watched a species of worm construct its burrow by boring a short distance and then lining the wall with a substance to strengthen it. As he watched, the suggestion came to him, that with modifications this was the way for man to build tun-

nels, and since then tunnels under water have been constructed in this way, where before they were deemed impossible.

There are natural laws which have a wide application, but, to see their application in daily life, children must be guided to that point of view, which can see in the boring of a humble worm a system of conduct, a method of operation, that mankind may use to the great advantage and progress of his civilization.

Wealth.—In the Garden Nature is a perfect teacher of economy and thrift — showing both sides of the question — certain operations leading to production, other operations leading to barrenness. The rational being can deduct simple rules for guidance that will be practically infallible. Nature says, “Watch.— Learn how I work.— Bring together the materials for me to start.— I will work for you with many forces.— For every move you make *with me*, I will move many times *for you*. But if you do not learn of me — how I work and what I need — if you disobey my ordered plans — if you do not supply my needs, you stand alone.” We cannot learn how Nature works unless we watch her at work.

Health.—(For the Individual and the Community.)

The spread of the most dreaded forms of disease is due to ignorance of laws of hygiene and sanitation. A knowledge of these laws, and obedience to them, by a very small part of the people, is almost ineffective. It is the mass of people who must understand and obey.

As example, malaria is carried from one person to another only through the bites of mosquitoes. The number of mosquitoes, in most localities, can be kept down to a very small number by well understood means. They breed in standing water. Standing water should either be removed, or covered against their entrance, or supplied with fish or some familiar creature to eat them. For one man in a community to know this and do it is of no avail, where 100,000 do not. The conditions must be reversed. The 100,000 must do this.

House flies, which breed in filth, carry disease germs on their feet, and every year bring sickness and death into thousands of homes. The public should know this and how to stop it. Remove the filth.—Destroy the breeding places. Not in one or two homes, stables, or shops, but in *every* one. With proper instruction every citizen would look upon a swarm of flies as a possible menace to his community and insist upon immediate removal of the cause.

In the Garden insects play an active part. Many of them are useful and welcome. But there is a never-ending warfare between the gardener and the insect enemies. Here is the place to educate the child to successful combat with such enemies. No mere brute force will do. He must think and plan; study the life history, discover the vulnerable points and strike quickly and surely.

Self-preservation is the first law of Nature. It has become an instinct in those who have survived. Shall

our education attempt to destroy this instinct, or shall we rather bring our educational methods to the assistance of the instinct, and teach the children to know their friends from their enemies; to gather their friends about them and call upon them for assistance, and practice vigilant, intelligent warfare against all enemies.

The knowledge of the danger and how to combat it must be given to the young — otherwise it does not result in action. And the methods taught in the Garden while fighting the cabbage worm, white grub, aphids, blister beetle, potato bug and mole will soon be directed also against house flies, mosquitoes, bed-bugs, lice, flies, rats, mice and kindred carriers of disease and destroyers of wealth.

Sunlight and courage have intimate relationship. In the "dog watch"—from two to four A. M.—man is most easily frightened. His vitality is at lowest ebb. His spirit is faintest. The sun has been away so long. After the long night with what gladness he watches the east lighten with the returning sun, and feels new courage quicken in his blood.

This is not fantasy but fact. Every night worker will tell you. Every physician will confirm it. Then why should we not plainly be instructed oftener to seek sunlight? It stimulates us to action, builds up our health and resisting power, and destroys disease germs.

Fresh air, which because of the recent agitation in the warfare against tuberculosis has been brought to

the attention of many people, is a striking illustration of one of the many points on which a general enlightenment would be of immense economic value.

That man's energy is produced quite as much from the air he breathes, as from the food he eats — and that as he reduces the amount, or quality of the air he *can* breathe, so he reduces the amount of energy at his disposal, is a fact the public should know. Not as an interesting bit of news, but as a vital law of Nature, which it is sacrilegious to break. The child's experiments in the Garden in learning the needs of his plants will give him this knowledge, which he will apply to himself.

Good food.—In the homes of poverty, there is often a waste of food, because of lack of knowledge. Money and labor are spent for food of low nutritive value. Ignorance of food values *may* bring poverty and *surely* increases it. What a valuable aid in the relief of poverty will come from a widespread instruction about garden crops and their uses. More food will be available. The instruction if given in the garden, while raising the vegetables, will never be lost, but at once begin to better the living of the well-to-do, and perhaps keep off starvation in the time of need.

Happiness is a state of mind to be induced by working in a healthy environment, at work which holds the interest and results in product of value to the worker and the community; stimulates his intelligence, adds to his knowledge, ministers to his desire for beauty, and increases his reverence for the Creator.

In the Garden is found work in the open air, various enough to fit any degree of strength and activity, producing food for the body and beauty for the soul of mankind, while surrounded by such varying delights for every sensory nerve as constantly to charm the dullest worker — even the deficient in understanding. For those whose minds demand problems, Nature quietly surrounds them with her marvels and mysteries, and with gentle, natural steps leads their intelligence from understanding to understanding, to bow at last with humble reverence before the Creator, and they find that in return for knowledge and obedience they are given a measure of control over wonderful forces and go forth among their fellowmen thrice armed for success. The child comes naturally and gladly to this work, but the adult who has never known it is surrounded with walls of habit and misconception that shut away beauties and delights that strive to reach him on every hand.

CHAPTER III

" PRODUCTION IS TRANSPORTATION "

Good roads and progress.— All over the country there is agitation to arouse the people to the benefits that follow the making of good roads. But adults have fixed habits, and even when mentally convinced, it is practically impossible to move them to action. Let the children be taught on the garden path and the idea fixed there will bear widespread fruit.

To-day the child plays in the garden. To-morrow it works as an adult. The direction given to its play to-day will decide how it will act in its work to-morrow.

Bring the subject suddenly to a roomful of adults and it seems too big and too far removed from them. It seems so complex and it is always apparently somebody else's business. But bring it to the child in the Garden, where he is to make his path, beside his own little farm, and the problem is simple, delightful and worth while.

It is much easier to push a wheelbarrow along a smooth path free from stones. A *loaded* wheelbarrow goes easier over a *hard* path. A path with a raised center lasts longer, and is dryer after rains, than a flat one, or one that is low in the middle. *The child*

who makes this path and who pushes his loaded wheelbarrow over it finds all this reasonable and simple and knows it should be so. And it is simple to one who has learned it this way.

The teacher who loves to watch the child develop its thoughts and actions under his guidance will find pleasure here. First the child wants to work. With the garden line and spade it fixes the path as it sees the others doing. Then it wants to work with the wheelbarrow, and carry loads. Now it begins to realize the difference in paths. The wheel bumps into stones, sinks into soft places, goes smoothly and easily over the level hard paths.

It only takes a few days for him to find out that he can carry heavier loads over the paths that are smooth, hard, level and free from stones, soft places and ruts. The next time he fixes his path he utilizes this knowledge.

The actual amount of saving can be shown to a child. No class-room talk on good roads can ever be as clear, or as lasting in results, as this actual work on the garden path. From such a beginning, as the child's instruction goes steadily on, let him read more and more meaning into the words,

“ PRODUCTION IS TRANSPORTATION.”

Every saving effected in transportation, especially where the saving is constant and cumulative, lessens the cost of production. Many a road has a short steep rise which could be removed at an expense very

much less than the cost of hauling over it, and which probably would be removed if those whose money pays for the hauling had begun to learn about good roads before they were twelve years old.

The nation is thinking about these things. Now must begin a method of teaching the child, that will lead to wider application of the knowledge in his adult years, and this teaching must be on the ground in the Children's Garden.

Children should be taught that the *wealth of the world* is produced by the *moving* of things. In the schools they should be taught how to apply this knowledge. Then every boy and girl, man and woman, would realize that any saving, in the cost of any step, in the production of any thing, means an increase in wealth. It is the application of this knowledge in the individual home, by the individual person, which is needed to relieve some of the present conditions.

In the Children's Garden this is well illustrated, and the results are apparent. Man cannot grow the crops, but he can move things about so that Nature will grow them. By careful planning what things to do, when to do them, and how to do them, Nature will give a valuable profit over the cost of the effort, but if the work is not done well, and at the right time, there may be a slight loss in every move, resulting in a large loss as a total.

Among the mass of the people this is perhaps the difference between those who are going ahead and those who are falling behind. Those who succeed

make a tiny gain on *every* move, and by constant study to *improve* the *efficiency* of what they do, they steadily *reduce* the *cost* of movement, and *increase* the product.

Those who fail make a tiny *loss* on *every* move, and by constant *neglect* to *improve* the *efficiency* of what they do, they steadily *increase* the *cost* of movement and *decrease* the product.

This is a valuable thing to teach, and the Garden an excellent place to teach it. All through the season opportunities multiply themselves to illustrate this point, namely, in preparing the soil, planting, weeding, watering and harvesting.

Each bit of movement and labor is connected with a past and future effort, and the child can be guided to study, plan, and experiment, to get large returns from low cost in energy. And as a result to save steps, labor, time, money, strength and health, and gain larger net returns in vegetables, flowers, health, strength, pleasure and knowledge, for himself and for his fellowmen.

CHAPTER IV

HOW THE GARDEN WORK TRAINS FOR OCCUPATIONS OTHER THAN GARDENING

The garden work teaches the child to *think* about what he is doing, and the manner of doing it.

It teaches, observation of *how others work*, and leads to the application of better methods to his own work; the value of orderliness and system for general economy and effectiveness; how to direct his strength *by education* and thus to direct others, and the value of *planning* a series of actions to obtain a desired result.

The child must be guided to find out things through his own efforts and experiments, and given that kind and amount of assistance which will open the way, keep up interest, and avoid discouragement.

The pedagogy of the spade.—Applied physics and economy of effort; development of *reason* and its application, as taught through the use of the spade.

To teach:

1. The three laws of the lever;
2. That a small point will enter more easily than a large one;

3. The value of keeping the back straight as much as possible in doing the work;

4. Economy of personal strength by using the weight, when possible, instead of the muscles;

5. The value of doing each part of an operation so as to save labor (or material) in each future stage of the work;

6. The value of an instant's relaxation at certain points in a series of movements;

7. The individual speed limit.

1. To teach the three laws of the lever.—

P	F	W	P	F	W	P	F	W
Fig. A.			Fig. B.			Fig. C.		

P = power — force applied.

F = fulcrum — point of support.

W = weight — to be lifted or moved.

Fig. A with fulcrum in the middle, 1 lb. power will move 1 lb. weight.

Fig. B with fulcrum four times as far from W as from P, 1 lb. power will lift $\frac{1}{4}$ lb. weight at W.

Fig. C with fulcrum four times as far from P as from W, 1 lb. power at P will lift 4 lbs. weight at W.

First let the child lift a spadeful of earth, with the right hand grasping the handle and the left hand grasping the shaft close to the blade. Then let him slide the left hand slowly back close to the right hand. As he does this the spadeful of earth seems to grow

heavier and heavier. *In fact, it may take four times as much strength* the second way as it did the first way. Or one boy doing it right can do as much as four boys doing it wrong.

If he looks for the operation of these laws in each step of his work, he will soon discover a means greatly to enhance the amount and quality of his spading with the strength *he has*. And this may change a difficult task to an easy one, or an unpleasant task to a pleasant one, or an apparently impossible task to a possible one.

Think of what such a conception may mean to a boy as he faces the world. He will say, "There is a method of doing things well and that method is based on fundamental laws. If I learn what they are and use them it will make my life much more happy and successful." He may not say these words, but he will absorb the general idea and spirit and it will soon show in his work.

2. To teach that a small point will enter more easily than a large one.—The corner of a spade will enter the earth when the ground is too hard to admit the whole edge at once, and a spade moved sidewise under pressure, will also enter more easily than when pushed straight down. From the doing and observing of such things one can learn how to accomplish many tasks more easily, even if one never learns the *scientific theories* regarding a wedge, and a cutting edge. The knowledge can be applied to mental tasks as well as physical ones.

3. To teach the value of keeping the back straight

as much as possible in doing work.— When a person has learned to do this in spading, the work becomes much less tiring. Whenever one bends lower over a task than is necessary, he puts more strain upon certain muscles of the back, and usually this strain is constant and unrelieved by motion. The taller the



Photos by the Author

Uncomfortable. Severe strain.
Loss of energy

Easy position. No strain.
Economy of energy

person the greater the strain, and a continued effort is much more tiring than an intermittent effort. Such positions should be avoided when possible. In spading, one may remain bent over much of the time, or, one may bend only during the lifting of the spadeful, and remain straight two-thirds of the time.

In many other tasks in life a change of position at work; as sitting in a lower chair, or having a higher or lower table or desk to sit or stand at; or squatting instead of bending over, will very much relieve unnecessary strain upon the back, and all that is un-

necessary is wasted strength which might be put to better use.

4. To teach economy of personal strength by using the weight, when possible, instead of the muscles.— In the many daily tasks muscle is often used where weight would do instead. Usually this means wasted strength, and frequently the weight, when it is used, is not used to good advantage.

In teaching persons to use a spade this is very apparent. When they have learned how to step on the spade and press it into the ground without stamping their feet sore, and realize how much more economy of energy they have learned, they begin to apply this knowledge to other tasks.

It is this wider application that makes the first instruction valuable. The energy economy becomes cumulative as one task after another is lightened by this knowledge. It is a good practical habit to seek knowledge that will have a cumulative value.

5. To teach the value of doing each part of an operation so as to save labor (or material) in each future stage of the work.— In spading, the earth *can be* so handled that the final grading and raking is reduced to a minimum. This affords a valuable opportunity to point out how to save work by planning ahead and making each operation count for as much as possible. In garden work this point will have many immediate and obvious illustrations. In teaching children we need prompt illustrations, often repeated, to leave lasting impressions. And the illustrations are

more valuable when they are made in the course of the regular work.

6. To teach the value of an instant's relaxation at certain points in a series of movements.— This does not need so much emphasis because the body will force it upon the attention. If the value of the economy of strength was realized more fully, moments of relaxation would be inserted and the work improved by doing so, and many an unnecessary breakdown be prevented.

In a task that is requiring concentrated effort, or a fixed position, the strain is great. A person spading steadily, without any moment of relaxation, will soon tire, but there are two well-marked places where they *can* rest for a fraction of a second, and should do so to avoid rapid exhaustion—just after pushing the spade into the ground, and just after the completed operation. Both rests come while standing upright. With this knowledge applied, one can spade very much longer without tiring.

7. To teach the individual speed limit.— This can be well taught in spading, and is a valuable thing to learn, for it has a wide application. Each individual worker has a certain speed of working at which he will do his very best, and if he works either faster or slower the result will not be as good. To work too slow results in lack of attention. To work too fast results in slipshod work. Every individual has a different speed limit for good continuous work.

Roughly speaking, if they double this speed they

can only work one-quarter as long. If at triple speed only one-sixteenth as long. The boy or man who is spading at his best speed, is paying attention to his work, and using *all* the energy that his body can supply easily and without strain. Slower work means some surplus energy not used on the spading. This surplus leads to looking around, talk on other subjects, the mind on other things. Hence work of lower quality, as well as smaller quantity.

Faster work means — inattention to details, hence poor quality; greater likelihood of mistakes and more rapid exhaustion due to the overload on the body engine. When this is repeated the engine wears out rapidly, whether boy or man, steam or gasoline. If a person has to work steadily, day after day, and turn out good product, he should learn his speed limit, and adhere to it.

Paymasters have calculated that a certain piece of work that a man will do in one day for \$1.00, he will do in one-half day for \$2.00, or in one-quarter day for \$4.00, and the same general rule applies to unpleasant work. *What a man will do for \$1.00 a day for pleasant work, he will do for \$2.00 a day for disagreeable work, or \$4.00 a day for very disagreeable and annoying work. What a man will do for \$1.00 a day for very safe work, he will do for \$2.00 a day for slightly dangerous work, or \$4.00 a day for risky work, or \$8.00 a day for very hazardous work.*

Combine the elements and the wages must be added together. Laborers in caissons get \$2.00 per hour

and can only work two or three hours each day because of the difficulty. The risk and annoyance are also very great.

That is the sum of Speed	}	= \$2.00 per hour.
Annoyance		
Danger		
When the same class of labor	}	= \$.20 per hour.
with these elements removed		

CHAPTER V

THE GARDEN A PLACE TO TEACH ECONOMY

The garden is an excellent place to learn the difference between true and false economy. Merely to avoid spending is not economy. But to spend in such a way as to average the largest returns in net profit, is true economy. Actual money is not the only thing that can be spent wastefully in a garden, but also labor, time, strength, seeds, manure, water, air, and much else, and net profit need not be measured in actual cash—but *profit should be desired*, and an amount of profit that will make labor worth while.

If the garden is being conducted for cash returns it should give returns approximate to what could be earned in other pursuits. If health is the object, health should not be sacrificed for some other form of profit. If knowledge is the object, the garden should be made a laboratory for investigation. Many a future commercial and home garden will give returns in knowledge, health and cash where the owner learned these first principles in the School Garden.

Education applied in economy of effort.— Practical problems will lead the boy and girl to logical reasoning better than any other method.

This kind of instruction leads to more intelligent use of time and strength in every task throughout life. The economy possible is great, and each child that



Photo by the Author

Load near the hands; heavy chalk line shows location of the load



Photo by the Author

Same load nearer wheel, one-third easier to lift. Vertical chalk line marks new location of the load

comes into the world will need to be taught how to save time and effort and material in daily tasks. The Children's Garden supplies object lessons of universal application.

With all the rapidly multiplying labor-saving devices in machinery — we are not yet giving enough attention to the most wonderful of all, the power of the brain

to direct the body's work in daily tasks. The work of the world is so divided among many individuals that the tremendous waste effort is scarcely noticed.



Photo by the

Side off, showing proper location of the load

But it is there and well worth the consideration of those who teach the Nation's children. Very few adults can learn how to save effort. It must be the children who are taught.

Think for a few moments of the different tasks



Photos by the Author

Carrying water. Six quarts in one hand. Note the strained position

Carrying water. Four quarts in each hand. Much easier and a third bigger load

performed each day, and repeated day after day, three hundred and sixty-five days each year for twenty, thirty, fifty years. Imagine a slight saving of time or strength on a few of them, because of attention having been directed to them. The economy to one person would be great and well worth while. Multiplied in terms of State and Nation means National Wealth.

To make the worker more comfortable and more efficient is not puerile, especially if the worker is yourself or your employé. Can the short persons and the tall persons work equally well at the same height table? Is it foolish to think of it, when raising or lowering the table will increase the output ten per cent., while the work at the same time becomes easier? Is the education that will make people think of these things worth while?



Photo by the Author

Proper size tools. Right and wrong size tools for the size of the worker

Every task in the Children's Garden brings up the question. The arrangement of the plots and paths is specially planned for this purpose. *To learn to think*



Photo by the Author

Proper size tools. Note overstrain on the boy with the larger spade

about the work and the manner of doing it, and then to make the efficient way *a habit*. After the instruction in a properly conducted Children's Garden has made its impression on the child's plastic memory, and it has formed the habit of acting upon this instruction, it will continue to reason and to act along the same lines thereafter.

CHAPTER VI

"OUR GARDEN"



"Our garden"

Photo by Levick

Contrast the ordinary nature-study of the classroom, where yesterday the talk was of rabbits, to-day of butterflies, and to-morrow of golden-rod, as abstract subjects, with the nature-study in *our own Garden*, where all the objects have an intimate relation to *us* personally.

The butterfly may come from a caterpillar which eats *our* plants, and is, therefore, *our* enemy, not merely *an* enemy. The fly that hovers over some flower in *our* garden may be able to destroy *that* caterpillar, and, therefore, we class that kind of fly as *our* friend. The bee may be necessary to make *our* flowers bear fruit. The earthworm, that we turn up in *our* garden, is *our* friend. All of these things come to us with an intense interest because they are in *our own Garden*, or give *us* pleasure by their beauty or help to cultivate *our* soil, or demand from us warfare against them *to protect our Garden*.

If the purpose of a Children's Garden ended with a little digging in the ground and the learning how to grow vegetables and flowers, it would not warrant the establishing of them in many schools. A far broader and deeper national usefulness can be obtained from properly-conducted Children's Gardens, and it is this broader educational value which appeals to those who have watched the work. By taking advantage of the child's natural desire for muscular activity in the open air, at the age when its five senses are seeking expression and development, it can acquire valuable and useful knowledge, in this garden work, which appeals to it as play.

The muscular restrictions of the class-room are relieved by a period in the garden, without interrupting the plan of study. To learn through seeing Nature's phenomena, while working under the guidance of a trained teacher, who makes the lessons fit the child's

years and the child's natural method of acquiring knowledge, gives more lasting effect than where the same instruction is merely dictated, or where it is read from a text-book.

Contrast the dull, abstract lesson on hygiene in the class-room with hygiene as taught in "Our Garden,"



"Our gardens"

Photo by Levick

where the fresh air, sunlight, proper temperature, cleanliness, warfare against insects, bacteria, and fungi are matters vital to the life and health of *our* plants.

The same applies to lessons on true personal economy as they affect the individual in their daily life; lessons on work and rest, on grasping opportunity; on the

value of methodical work; on endurance; on the value of happiness and courage, and how to get them. Practical information given in so simple a way that even the deficient child can understand; given in so attractive a way that the children desire to do it that way, and throughout it all joy, beauty, and usefulness are interwoven with the course of study. What we enjoy learning we remember.

CHAPTER VII

PLAY

A Children's Garden should be conducted in such a manner as to satisfy the wholesome desire for play. The best results will be gained from the work done at the age when this desire to play is strongest. Children play with a great deal of earnestness and with much activity, and at the time when the garden is most beneficial in their education their plays consist in imitating the pursuits of their elders. The children will heartily enjoy playing at gardening, or house-keeping, or carpentry, so long as the work is well within their strength and limited to short periods of attention.

Just as the small chick loves to run out into the world and quickly back again to the warmth and protection of the mother wing, so the child loves to play at doing work and imitate grown-ups, especially in the arts and trades, if there is plenty of opportunity for change and rest.

For the Nation's safety the Nation's children must be educated, but that education would not be nullified by killing the child in the process. The *first* need of every child is a healthy body. Much mental stimulus

too soon will educate the brain *at the expense of health and endurance*.

At the age when a child is perhaps most interested to begin gardening its plays are largely imitation of its savage ancestors, and it may be more interested in making tools of wood, or stone, or shells, than in using modern implements, and to humor this desire develops a large amount of resourcefulness. This, a little later, leads to a better understanding of the value of modern tools than if the child had never worked with a pointed stick.

To grow his vegetables, conquering the soil and making it supply his wants; to prepare and cook these vegetables, and eat them right in his garden will delight him beyond measure. Even the city boy is more satisfied with the potato roasted in a bonfire in a vacant lot than he ever is when they are served at the home table. It is the little savage craving the life in the open. If he never has these experiences he loses a large part of his childhood and a valuable part of his education. The girl craves this as much as the boy.

CHAPTER VIII

CIVIC TRAINING BY MEANS OF THE INDIVIDUAL PLOT

Up to the time when the child reaches school age it has been very dependent upon everyone it comes in contact with, especially the mother, and for several years after this it will be a dependant and an infant in the eyes of the law. At no period of its life in civilized communities will it ever be strictly independent, but there should be a well-developed sense of self-reliance and desire to carry on independent thinking and effort. Before teaching co-operation, instruction should come in developing individualism. The higher and more complex the civilization the more dependent is each upon all the rest of the community. Co-operation and independence go hand in hand, but without an early and sound instruction in personal privilege and duty the enforced dependant tends toward a shirking of public responsibility, except in those of most pronounced character. Therefore, it should be the duty of the system of education to train individuals to know their rights. A community, like a chain, is only as strong as its weakest link and the effort should be made to raise the standard of the average and the mass rather than to add more strength to those already strong.

The little child will some day be thrown upon the world as an individual to earn its living, protect its health, assume its burden of taxes and its share of public morals. A great many children must undertake these responsibilities at an age when they are very easily misled by their environment, and several years under the age when the law declares them no longer infants. Our present public school system is an absolute monarchy and hardly in the slightest degree does it give any training in a moral assumption of personal responsibility and independent thinking. In fact, those bolder natures who decline to live in an absolute monarchy and declare for individualism in their instruction and rebellion against all that absolute monarchy implies, here, in our American Republic, are placed under the ban of the law and kept, against their wills, in schools that are virtually prisons. These are the boys and girls who play truant and they play truant usually because they love out-of-doors with a passion not to be subdued, and they cannot understand the need for learning things that they cannot use. The Children's Garden, based on the individual plot and all that it means, is the best opportunity to teach good civics without interfering with the present school regulations.

CHAPTER IX

THE DIGNITY AND HONOR OF MANUAL LABOR

Is it desirable to believe in the dignity of manual labor? Compare the countries where men and women, able to work with their hands and proud of their ability to do so, are not restricted from rising to the highest positions, with those countries where manual labor is looked upon with contempt by a patrician class; where *caste* lines, in this regard, are so strict that manual labor is considered degrading and defiling. Compare the United States, Germany, France, England, Denmark and Switzerland, with China, India, Korea and Ceylon. In the former, the brains, the progressive spirit, and the inventive skill, of thousands, *the workers*, keep their countries continually in the front line of civilization. In the latter, where *farmer* is synonymous with serf; where the artisan and mechanic are never allowed to be leaders in any large sense; these countries have advanced but little in their civilization during a thousand years.

The teachers of a land can form the trend of thought of the next immediate generation. If they preach and practice a belief in the dignity and honorableness of manual labor the result is to improve the standard of labor. The men and women who labor

with their hands will not feel the dignity and honorableness of their labor unless their work is well done; unless they realize the vital part played by the products of the labor; unless their hands are backed by trained intelligence. The instilling of this idea will lead men to constantly demand a better class of work from themselves and a better wage for their products.

False ideas about working with the hands will never have an opportunity to take root in the minds of children, whose education has embodied a proper amount of manual labor, such as the Children's Garden affords, for here they learn what relation the products of their labor have to the welfare and progress of their country, and they will take pride in their ability to share in this welfare and progress.

CHAPTER X

GENERAL EQUIPMENT, CARE OF TOOLS, AND REMARKS

List of equipment.

Rakes, one for every five children.
Hoes, one for every five children.
Spades, one for every five children.
Spading forks, one for every five children.
Watering pots, one for every five children.
Small garden lines, one for every five children.
Plot stake, one for each plot.
Cultivating stick, one for each plot.
Diary, one for each plot.
Hand carriers, several.
Marking board, one.
Set of sieves, $\frac{1}{2}$ ", $\frac{1}{4}$ ", $\frac{1}{8}$ ", $\frac{1}{16}$ " mesh, one each.
Set of measures, 1 quart, 2 quarts, 1 peck, one each.
Large garden lines, several.
Wheelbarrow, one for each fifty children.
Insect outfit, one.
Seed bottles for planting, seven.
Seed vials, set in a box for study.

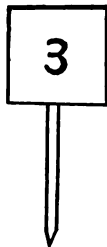
Sundries.

Auger.
Claw hammer.

Crowbar.
Files.
Floor broom.
Gas pliers.
Garden hose.
Hatchet.
Jackknife.
Mallet.
Monkey wrench.
Nails.
Plane.
Pincers.
Pipe wrench.
Paint and brushes.
Pickaxe.
Raffia.
Rake, large size, steel.
Shoe brush.
Spade, large size.
Saw.
String.
Screws.
Trowels.
Tape measure.
Whisk broom.
Whetstone, and other things as needed.

The plot stake.—Where the material can be obtained, the children can make stakes for numbering their plots.

This will furnish excellent shop work. From planed lumber six inches wide and one-half inch thick, six inch squares are sawed off. The upright is made of inch square strips sawed in eighteen inch lengths. The six inch square is nailed at the top with the grain of the wood at right angles to the upright. The stake is then painted with a thin coat of green paint well rubbed in so as to leave no thick spots or drops. Stencils for two and a half inch numbers are then made from thin cardboard by copying from other stencils or tracing numbers cut from a large size calendar. These are placed on the front of the stake and with a soft lead pencil the outline of the number is traced in. With thick white or red paint these outlines are then filled in, using a small camel's hair brush.



The plot stake



Painting plot stakes

Working in this way the child gets some very good practice in carpentry, painting and lettering, and can turn out a very workmanlike product. These stakes are quite durable and need not be made every year, but the paint and lettering can be freshened up each season. Brass nails do not rust

and will last much longer than steel wire nails. The end of the stake which is to go in the ground should be pointed and pushed into the ground six or eight inches.

It is placed at the middle of one end of the child's plot. If the ground is hard, to avoid breaking the plot stakes by hammering them into the ground, use a pointed stick and wooden mallet to make the hole first.

Cultivating stick.— This is made of a piece of wood whittled to fit the hand, and with a point. Hard wood is best. The stick is grasped as far from the pointed end as the depth



Cultivating stick to be loosened, and the work proceeds forward with a chopping movement, loosening the soil, making it quite fine, and easy to remove the



Splitting off pieces for cultivating sticks. Note the useful hand carrier



Photos by the Author

Shaping and pointing the cultivating sticks

weeds. One of the great advantages in the use of the cultivating stick is to bring the eyes of the workers

near to the soil, where they can see many things, like small weeds and insects, which they would not, if standing up. In Children's Gardens where the plots are quite small the cultivating stick will do all of the work necessary after the planting, and can be made to take the place of the hoe, rake and trowel. It is made by the children themselves. In some Gardens where there is no money to purchase tools all the first preparation of the Garden can be done with borrowed tools and these cultivating sticks can finish the work throughout the season.

If these sticks are made of hard wood, like oak, they will prove more serviceable, but the child should learn to use whatever wood is at hand, selecting the best. The finding out by use that hard wood will hold a point when soft wood will not, or that the end of a stick can be pointed by burning and rubbing, when no knife is available, and that its point is harder because of the burning, makes excellent nature study.

Children using a stick the size of a lead pencil have gained manual dexterity which has been of direct benefit in teaching them to write and draw. The effect on deficient children has been especially noticed.

Garden lines.—The garden line is very important and is too often neglected in Children's Gardens. It should be used wherever a straight line is desired, and for making curves and circles. In placing the line the stick at each end is pushed into the ground until the line is down to or just under the surface,

which will hold it firmly. Let the children learn how much more strain can be put on a line fastened this way, than where the strain is from the top of the stick, several inches above the ground.

For large garden lines, it is wise to buy the kind regularly sold for this purpose, because it is light, and stretches very little. These lines should be as long as the garden. At least one is needed and several, if possible. Old broom handles of hard wood make good end sticks.

For small lines, to be used on the individual plots, a large size mason cord is excellent, but any firm twine will serve the purpose. These should be long enough to go the length and across one end of the four by eight foot plots. A little over twelve feet long. The end sticks should be of hard wood.

Seed bottles for planting.—There should be one bottle for each kind of seed used in the children's plots. Ten to fourteen ounce bottles will hold enough seeds for thirty plots. Be sure the necks are large enough for the seeds to pour out easily. Each set of these should have a special small hand carrier made for it.

Seed bottles for study.—Small boxes, containing a number of small glass vials with seeds to be studied, are convenient. The labels may be placed inside the vials. In large Gardens each teacher should have one of these sets for frequent reference.

Hand carriers.—These are useful in themselves, and important in the child's education. When gathering weeds or trash, the child should learn to put them

into something ready to carry away, and save the unnecessary labor of a second gathering. Often there is not time for this second picking up.



Designed by the Author

Seed set for study

The carriers may vary in size and be made of different kinds of boxes or baskets. Making these carriers furnishes good handcraft for the children. Various-sized cigar boxes with loose string handles, so the boxes may be nested, do nicely for small loads. Heavier ones may have rope or wood handles. Wooden barrel hoops make good handles.



Hand carrier

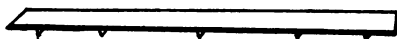
Marking board.—The marking board is made of a piece of board four feet long, three inches wide, and one inch thick, planed on both sides, and five cleats, each three inches long and one inch square. These

cleats are nailed on the board to correspond with the furrows in the child's plot as follows: The board is four feet long, which is the width of the plot. One cleat is nailed in the center, two a foot on either side of the center, and two more twenty inches on either side of the center.



Marking board, bottom view

Each cleat is fastened crosswise to the board with three nails of suitable length. The cleats are whittled, or planed, to an edge, either before or after nailing. A couple of



Marking board, side view

laths can be nailed to this board as handles, to keep the user from the necessity of bending over.

How to use a marking board.— When the children's plots are ready for planting and the surface raked fine and level, a short time before the planting lesson is given, an instructor, or one of the older children, takes the marking board to each end of each plot and placing it square across, with the central cleat right on the middle line, steps on the board and presses the cleats into the earth. This makes five marks at each end to show just where the furrows are to be.

Purpose of the marking board.— By the use of this marking board many plots can be marked rapidly and exactly. At the time of planting these end marks can be connected with a furrow drawn free hand the

length of the plot, or with the garden line to insure straightness.

Sieves.—A set of these are very useful, to separate soil from raked-up trash, to get fine soil for potting and experiments, and to separate soil to see the different particles which make it. They should be of different sizes to nest when they are put away.

Make square frames of planed inch lumber of any desirable size, from one to two feet square, and nail wire mesh to these. Hardware stores usually keep all the different-sized meshes needed.

Wooden mallet.—The wooden mallet consists of two pieces, the head and the handle. For the head a maple branch that has been lying on the wood pile for a year is excellent. Saw off a suitable piece. Bore an inch hole through the head midway between the ends. Shape the handle smooth and round, a little smaller than the hole in the head, except for about one inch at one end, which should be larger than the hole. Insert the small end of the handle into the hole and push the head down until it sticks. A couple of light taps with the hammer on the outer end of the handle will secure the head. To remove the handle tap the inner end. The end should protrude about an inch.



Wooden
mallet

Raking.—To separate and remove trash, use a rake with teeth at least one inch apart. Hold the handle of the rake nearly upright. When the rake is on the

right side of the body the right hand is above the left. The handle is grasped lightly. The hands well apart. Reverse the hands when the rake is on the left side of the body.

To move soil or level it or scratch it deeply, hold the rake handle nearly horizontal so the teeth point down. Grasp the rake with the hands well apart. Left hand in front of the right for right hand use.

In teaching children to use the rake it is wise to use those made of malleable iron because when they are bent they can be straightened again easily and without breaking. These are also much cheaper than steel rakes. For smoothing the earth to obtain a very fine surface use the back of the rake. Rake handles should be marked for such measures as will be needed. The best way is to burn rings on the handle, marking inches and feet.

Spading (right handed).—In spading place the right hand on top of the spade handle and the left hand beside it. Place the left foot on the foot rest and press down firmly, using the weight of the body without stamping. If the ground is hard the right corner of the spade can be inserted first and the spade straightened as it is pushed down. This will make the spade go in much easier, just as it is easier to push the point of a knife in. When the spade has been pushed into the ground to the depth of the blade, lean backward on the handle until the spadeful of earth has been broken loose, and while the body is bent over slide the left hand down to within a few inches of the

blade and turn the spadeful of earth over just in front of where it is taken up, and then stand up straight. Break up the lumps of earth with a *chopping* motion. Neither spades nor rakes should be used to pound up



Photos by the Author

Spading, first position

Side view. Spade blade half down. Note the narrow trench kept in front of the spade

Second position. Breaking the spadeful loose by leaning, before lifting it.

hard lumps of earth, as this will sometimes break the tools. If care is used while spading, the ground can be left quite level, and this will reduce the amount of raking necessary.

Spades can be purchased which are about two-thirds the size of the large garden spade. They should have foot rests.

Hoeing.—It may be well to shorten the length of the handle of the hoe for the use of children. The

hoe should be held in positions described for raking, and loosening of the soil should be done with a chopping motion, working forward.

Beginners have a tendency to pull earth over the unhoed portion by working backwards. This is the most difficult thing to overcome, and it will be easier to teach the use of the hoe after they have learned to use the cultivating stick.

Hoe handles should be marked for measures like the rake handles, in inches and feet.

Watering pots.—A six quart pot is large enough for the average child. Usually the holes in the sprinkler are too small, and should be enlarged. Do this with a block of wood, wire nail and hammer. Where there is no money, fair substitutes for watering pots and pails may be made of the gallon tin cans in which baker's buy fruits and vegetables.

Tubs at hydrants.—Where running water is supplied, it is well to have large half barrels, or tubs, into which the pots may be dipped. These tubs should be surrounded with cobble stones, or gratings, to avoid mud. Handles may be made for these tubs by boring two holes six inches apart opposite each other and running through them three-quarter inch Manila rope.



Photo by the Author
Half an oil barrel for a tub

Wheelbarrows.— It is wise to have well-made wheelbarrows, as they will then last for years. It is very



Photo by the Author

Wheelbarrows stacked. Cleats to hold the wheels

important to have the wheelbarrow the right size for the child who is to use it.

Diaries.— It is an excellent plan for each child to keep a simple diary, to record the work done each day. The book should not be too small. The ordinary ruled copy book, 7x8 inches, is good. Each entry should be dated. The entries should include:

What is planted, and time of planting.

What is harvested, time of gathering, and quantity (by count, measure or weight).

The kind of work, like spading the plot, fixing the path, transplanting, thinning, etc., and the state of the weather.

A habit of this kind is an important assistance to success, and many farmers could improve their methods by keeping a record of their work and observation



Photo by Mahoney

Shows child's diary for plot No. 50. Teacher's seed set. Sawdust box with bean plant with pod on it, grown in sawdust. Young lettuce and sprouted beans.

each year, and planning future work on this record of their experience. The time to start the habit is while they are children.

INSECT OUTFIT FOR CAPTURING, KILLING, PREPARING AND MOUNTING INSECTS FOR PRESERVATION.

Butterfly net.—For occasional use it can be of cheap material and give very satisfactory results. A

yard of mosquito netting, a piece of heavy wire, about three feet long, a half inch by three foot dowel stick, and a yard of thin, strong twine. The wire hoops of flour barrels can often be furnished by the children and are about the right size wire. The handle can be whittled from a piece of pine, and string is quite common. The materials are put together as follows:

The wire is bent into a circle and the two ends are bound to the end of the handle for a distance of three or four inches. The tips of these wire ends are bent at right angles and inserted into the holes in the handle to keep the wire from twisting. In binding this wire to the handle it should be carefully and neatly done, with both ends turned in and without knots. If the butterfly net is to be used vigorously and often, it is economical to get more serviceable materials.

Probably the best is to make the hoop and handle of one continuous piece of suitable rattan, about the size of the little finger. If it is soaked in water for a day and then bent about a form made by driving nails or pegs of wood in a board and then the handle is bound while it is wet, it will remain in that shape when dry. The net is made of bobbinet, which costs more than the mosquito netting, but is much stronger.

Poison jar.—After the butterfly has been captured it should be quickly placed in a poison jar to stupefy and kill it quickly, so that it will not damage itself by struggling to escape. A good form of poison jar is made of the Atlas Special preserve jar, which has an

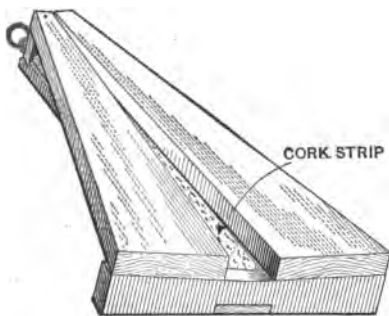


Photo by Mahoney

Insect outfit. Net, box mount, riker mount, insectary, poison jar, vials of dilute formaline with insects, tweezers, pliers, magnifying glasses

extra wide mouth, and is shallow so that the insects can be picked out of it easily. Into this place a piece of cyanide of potassium about as big as the thumb. Cover this with plaster of paris, add enough water to harden it, and leave the cover off for about an hour to dry; after this, keep the cover on tight to retain the poisonous gas. This material is very poisonous and should not be played with. The jar should be carefully marked in large letters POISON, and with the usual skull and cross-bones label.

Spreading board.—After the insect is dead, but while it is still soft and moist, it should be pinned to the spreading board in whatever position you wish it to remain when mounted, and left in this position until it is thoroughly dry. It is fastened to the board with pins and small strips of heavy paper or thin cardboard. Ordinary pins can be used but regular insect pins are more satisfactory. They can be purchased in several sizes. They are longer and thinner than ordinary pins.



Parsons' Insect Spreader with universal slot

The spreading board should be made of soft, white pine, planed smooth, half an inch thick, two or three inches wide and a foot long. The slot at one end is

$\frac{1}{8}$ inch and widens to $\frac{3}{4}$ inch at the other end. If a staple or screw-eye is fastened at one end of the spreading board it can be hung up while the insects are drying. They should not be left too long where spiders may reach them because spiders are apt to eat the bodies of the insects, especially butterflies.

Mounts.—After the insects are dry they can be placed in mounts for permanent preservation. There are three good kinds of mounts. One is a carefully-made wooden box with a glass cover and the insects can be arranged in this by fastening them with pins stuck through them. Another, called the Riker mount, is a cardboard box filled with cotton on which the insects are laid, and the glass cover pressed down. This shows only one side of the insect. Another kind is called the Denton mount. This is all of glass and holds the insect in such a manner as to be able to see both sides of it.

If caterpillars are to be preserved with the butterflies they can be placed in small bottles with diluted formalin and corked up.

For printed information about insects the United States Government and the State Experiment Stations furnish excellent bulletins without charge, and there are a number of books, which the school or town library may obtain if there is a demand for them.

Knots.—There are three qualities essential in a good knot; to tie easily and quickly, to hold securely, and to untie easily and quickly.

The dictionary shows how to make the simpler knots

correctly, and the children should learn and use them in the garden.

The most generally useful are the square knot, bow-line, and two half hitches.

Care of tools.—

Keep tools in a suitable place, protected from the weather. Racks should be made to keep them orderly. Always return tools to their



Photo by the Author

Rakes, hoes, and spades in racks

These racks were designed by the author. They will hold many tools in small space and allow each kind to be easily taken and replaced.



Public service. Collecting tools of the forgetful

proper place when through using them. If they are returned promptly, others can use them, and a few tools will do for several plots. Rub them clean with the hand, or a piece of wood. It can



Dry cleaning of tools



Equipment for gardening

Photo by Mahoney

be easily done just after using. If tools are dry cleaned in this way, they will seldom rust.

Do not make a practice of cleaning tools with water. They will surely rust. In some localities borers get

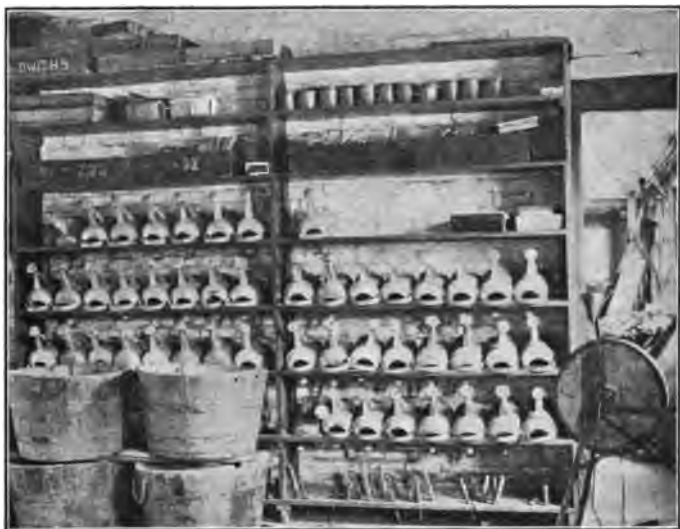


Photo by the Author

Racks designed by the Author to insure empty watering pots. Shows also water tubs with rope handles. Small garden lines in holes in the lower shelf. Upper shelves show boxes containing children's diaries. Also the useful grindstone

into the wooden handles. A coat of crude oil yearly will prevent this, or a thin coat of paint, which improves their appearance also. Spades and hoes will work easier if sharpened on the grindstone or with a file. Garden hose should be emptied before putting

away. Watering cans should be placed in racks in a position so that no water can remain in them.

Place to wash.—It is desirable to have a place in or near the Garden where the children can wash their hands. Usually the water tubs are enough. For children who were to return to the class-room one teacher arranged it as follows:

Small towels, just large enough for two pair of hands, were hemmed by the sewing class. The children dried their hands and placed the towels in a convenient basket or box. These towels were laundered by the Domestic Science class. This plan worked well.

CHAPTER XI

PREPARING THE SOIL

The ground should be cleared of large stones and rubbish and possible stumps, and the grass and weeds cut and removed. Spread well-rotted manure evenly over the ground, which should then be plowed, and



Photo by the Author

Weeds cut and piled

harrowed at least twice. If it is not possible to secure a good plowman, it is much better to have the ground spaded.

Use old, well-rotted manure, if possible, and if not limited in quantity have it two to four inches thick.

If only fresh manure can be obtained, give this the first attention and have it piled on a clear spot of ground as long as possible before needed. Even a



Photo by the Author
Spading and raking alternately

week or two will be worth while. It should be kept packed by tramping down, and if necessary water should be thrown on it so that it will not be destroyed by its own heat. If the ground is

prepared in the fall fresh manure can be used safely. For moving manure and spading it in, small spading forks are excellent. If these are not available, borrow a few stable forks to spread the manure and turn it under with spades.

No matter how small an amount of work is done, have it done carefully, especially spading to the depth of the spade blade, and breaking up earth lumps, leaving the spaded portion level as the work proceeds. If there is a large quantity of manure, be even more careful to spade deep and mix the manure thoroughly with the earth.

The average child of ten years and over, with proper tools and instruction, can do all the work, under a teacher who makes it enjoyable. This is really the



Public service. Volunteers spading for a new garden

way they should learn to prepare a garden — by actually doing it. Always have the children do as much of the work as their strength and time will permit.



Spring spading

Photo by the Author

The more children working together, the greater the enjoyment. Teach them to work with system and in a workmanlike manner. The child is a very reasonable being, and especially the American boy, who con-

stantly asks, "Why?" To intelligently answer his "Why," not merely with words but with object lessons in work which he performs himself, is one of the better means of maintaining his interest and teaching him to turn out workmanlike product. Keep the share of work, and the kind of work, well within the strength of each individual. Overfatigue is a common source of lack of interest.

Let us suppose a piece of ground covered with stones and rubbish and rather poor soil. Divide the children into groups. Give each group a section to clear of everything easily movable.

Children dearly love to use wheelbarrows. If there is a place nearby to dump what is cleared off, it can be carried there in wheelbarrows. If not, put it in piles in the least objectionable place and plant running vines, like pumpkin, to cover it.

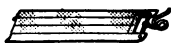
When the larger materials are cleared away, start the raking to gather up the rubbish. Small stores are not objectionable. Use as many rakes as possible and keep the rakers in a line. Give each a space of about six feet wide to rake. Have them leave the raked-up material in piles to be removed with wheelbarrows. Undesirable rubbish that cannot be carried away may be burned or buried. A handbarrow is a fair substitute for a wheelbarrow, and is made of a box with two side bar handles, and carried by two or four children; or a contrivance like the Indian Travois, two poles lashed at one end, with the other

ends trailing on the ground with bar, or box, or cradle lashed from pole to pole to receive the load.

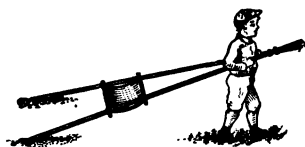
Burying large stones or logs.— Sometimes there are



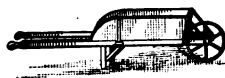
Stone boat



Sledge



Travois



Wheelbarrow



Hand cart



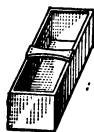
Hand wagon



Hand barrow



Hand carrier, barrel hoop handle



Hand carrier, straight handle



Hand carriers with loose string handles. Nested

large stones or logs on the surface which could be removed by burying easier than by carrying away.

To do this mark out a space the size of the object, and close up to it. Remove the top soil and place in a pile at one side, so as to put it back on the top when filling in again. Then dig a hole large and deep enough to bury the object, and have two feet of soil on top when covered. When the hole is large enough, undermine the stone or log *carefully*, so it will not roll in unexpectedly and hurt the workers. Then with crowbars or poles work it into the hole, cover it up and level the surface.

After the ground has been cleared, spread the manure and then begin the spading.

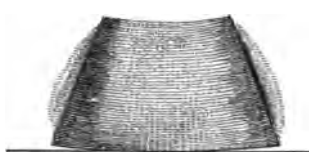
Show the children how to economize strength in spading by using weight and avoiding all unnecessary lifting. Keep the spading line straight. Watch the smaller and weaker children, and do not let them overdo. Those who do not have weight or strength to spade deep enough should be given something else to do, or it will be regretted later. They will apparently spade as much as those who are doing thorough work, but will only go down two or three inches, the bad effect of which will not show until it is too late to remedy it. Do not let the children run about on the freshly spaded earth of the garden.

After a strip of about four feet wide has been spaded let it be raked level and smooth by children standing on the unspaded portion. Thus, by spading

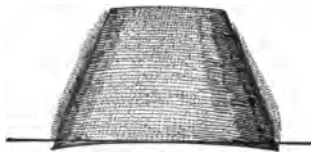
and raking alternately, the whole area can be finished without walking upon the loosened earth.

There should be no distinction as to sex in any of this work, and the teacher should work with the children as far as it is possible to do so, and *watch* and *instruct* also.

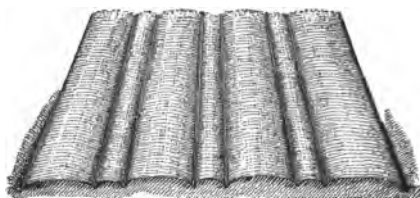
Grade the whole surface to avoid long-standing



NOT THUS



BUT THUS



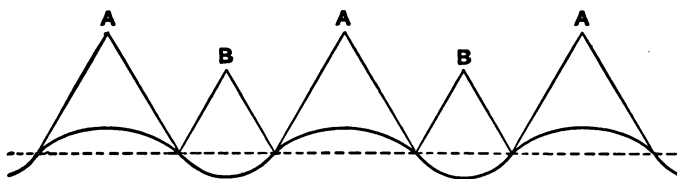
AND THUS



puddles. If the surface is flat, regrade so the center is slightly higher.

In changing grades, remember to save top soil. The top soil should be shoveled into piles, the ground be-

neath raised or lowered to the required level, and the top soil replaced.



If a surface like this is leveled with a scraper which merely drags the top of the high ground into the hollows until it is like the dotted line, the A spots will grow poor crops, and the B spots will grow good crops.

Care of manure.—In closely settled communities



Photo by the Author

Cover manure with earth to avoid flies

where an exposed pile of manure may become a nuisance from the odor, and a menace from breeding flies, store it as follows:

Dig a pit two or three feet deep and large enough to contain the manure. Put the manure in, pack it down well and cover with two inches of earth. If manure is to be collected throughout the year for the following season, a thin covering of earth should be placed over each lot put in. There will then be no trouble from odor or flies. Such pits are better if they have a puddled clay bottom. Anything that will make humus can go into this pit, if the material is to stand for a year or more.

Uses for material gathered in clearing up.—

Stones. Some may be placed around the hydrant to avoid mud. Others broken with a hammer and used in making large paths. Keep some for use in soil talks.

Weeds. Put in the manure pit for humus.

Wood. To be burned. Have a special place for the fire with a stone floor to save all ashes to be used for fertilizer. Burn all stumps, roots and wood not useful for construction. Gather the ashes and keep dry until used.

Glass, china, umbrella frames, tin cans, bottles and similar rubbish can be turned into apparatus for experiments.

CHAPTER XII

LAYING OUT THE GARDEN

Tools needed to lay out the garden.

Tape measure, 50 or 100 feet long.

Straight stick, $9\frac{1}{2}$ feet long, marked at 4 — 8 — $9\frac{1}{2}$ feet.

Nine strong stakes, 18 inches long, for permanent marks.

Several dozen small sticks a foot long for temporary marks.

Two (or more) garden lines the length of the garden.

Hatchet or mallet.

Hoes — rakes — spades.

The plan, when followed in detail, has so many advantages, which have been thoroughly tested for eight years, that it is given here complete.

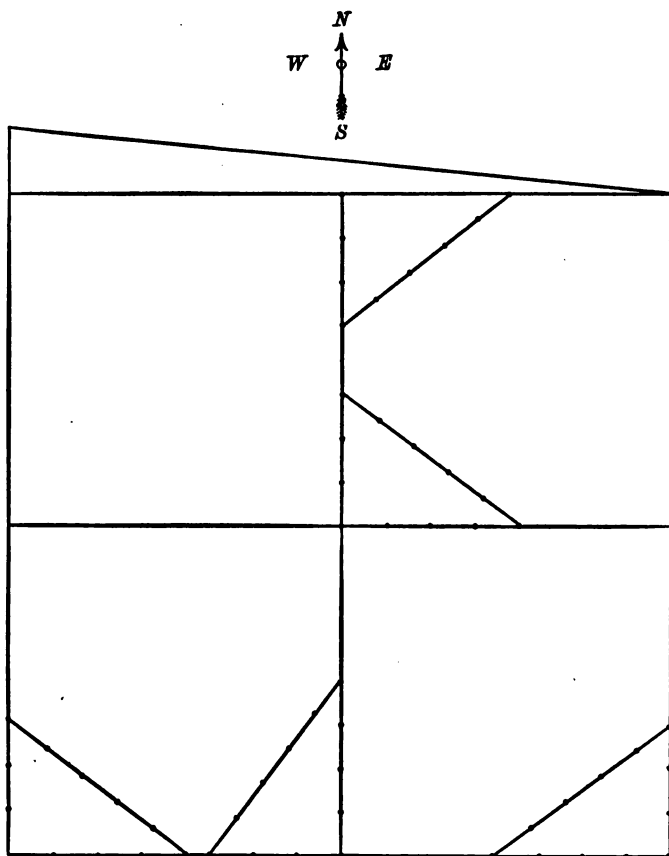
The photographs and drawings show the principal parts, viz.: The attractive center, like a flower bed or summer house — two large central paths, at right angles with each other, dividing the Garden into quarters, which contain the children's plots. On the outer border of the Garden observation plots for beauty and information. Between the observation

plots and the children's, a path which goes all around the Garden.

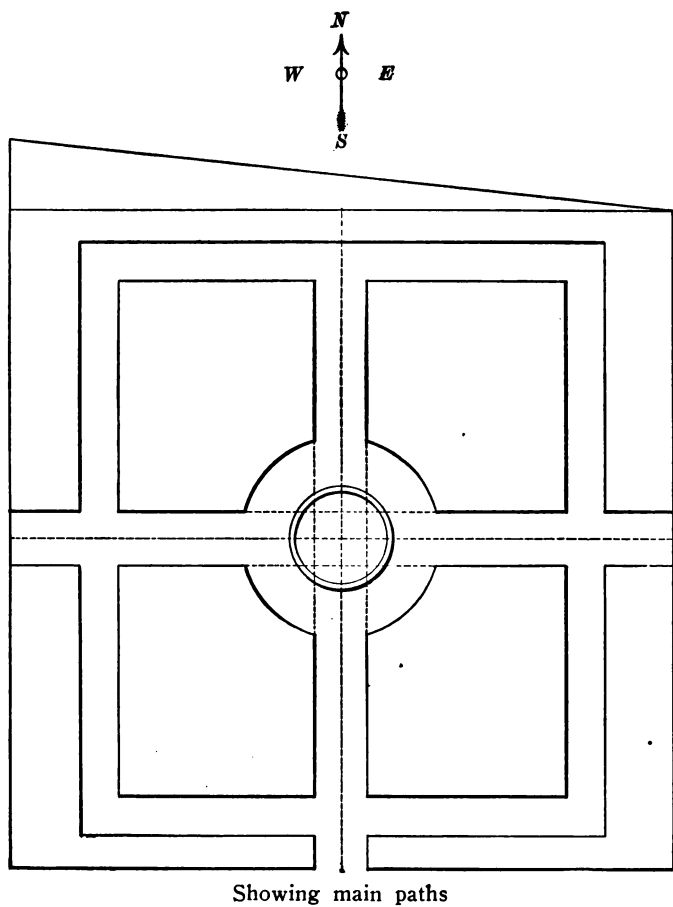
To lay out the Garden.— Make a straight line north and south where the center of the north and south middle path is to be. On this line, at the point where the main east and west path is to cross, make a straight line at right angles (see note at end of chapter). These two cross lines, at right angles to each other, one going north and south, the other east and west, will be the middle of the two large paths, which shall divide the Garden into quarter sections. The outside boundary of a large oblong should now be found, the opposite sides of which should be parallel and at right angles to the first cross lines made.

The measuring from now on should always begin from the center lines and work away from them. It is desirable to have the measurements quite accurate; therefore, use a measure that will not stretch. Some cloth tape measures do stretch. A steel one is preferable.

To mark out the main paths.— At the north end measure two feet on each side of the center line and mark with stakes. At the south end measure two feet on each side of the center line and mark with stakes. Connect these stakes with long garden lines drawn taut and with rakes and spades outline the edges of this path. Remove about an inch of earth from the sides of the path and throw it into the adjacent sections. Do not remove any earth from



Cut shows right angles marked with 3-4-5 spaces. See "How to make a right angle"

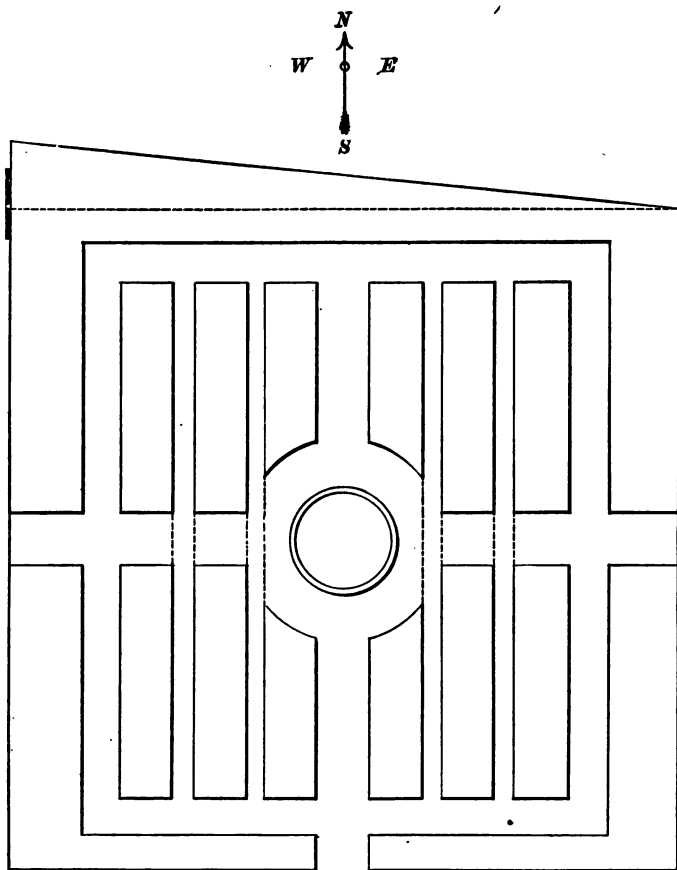


the center of the path. Repeat on the path running east and west.

It will be found useful to have heavy stakes for marks at the following points. One where the center lines cross. One at the outer end of each of the center cross lines. One at each of the four corners of the rectangle. Nine in all. The marks can be made permanent by sinking these stakes flush with the surface of the ground.

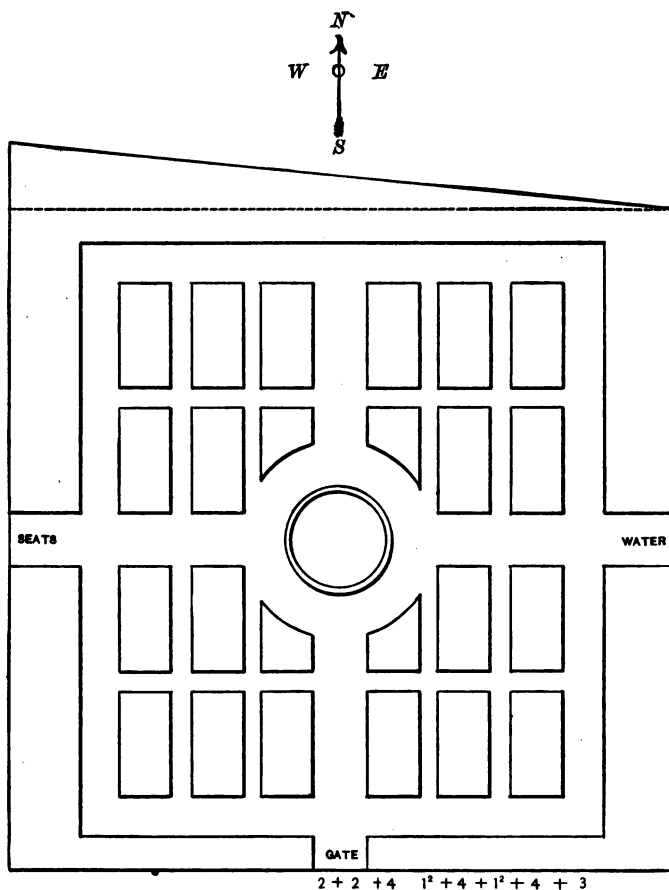
The individual plots should now be marked out by making the small paths which are to divide them. Begin at the north end of the garden and place small stakes where the paths are to be. Use the tape line. Start to measure from the center of the middle path. Allow two feet to the edge of the first plot, four feet for the width of the plot, eighteen inches for the small path, four feet for the next plot, eighteen inches for the next path, and repeat for as many plots as there are to be.

Repeat the measuring and placing of small stakes at the south end of the garden. Connect the stakes with long garden lines drawn taut, and have the paths tramped down and the edges marked permanently with spades and the backs of rakes. Two lines should be used in marking each path. Make all the small paths north and south first. When they are marked out, make the small paths east and west. Repeating the measuring, as before. Start from the center of the main path running east and west. Allow two feet to the edge of the plot, eight feet for the length



Showing small paths north and south

CHILDREN'S GARDENS



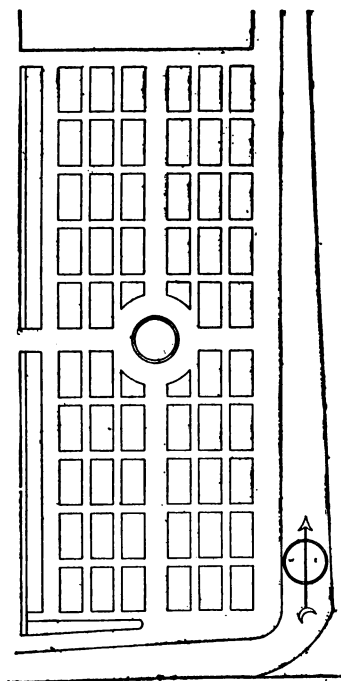
Showing all paths complete. This is the plan and measurement of the Children's Garden, Bellevue Hospital, N. Y. C. Installed by the Author, 1909. Fifty feet square. See photos under special gardens

of the plot, eighteen inches for the small path. When the stakes are placed for these paths, stretch the lines across the garden and make the paths.

Do not consider it time wasted to check measurements. Mistakes are easily made. After using the tape measure, use a light stick to check whether the stakes are put at the proper places. Lay the stick between each set of stakes to see if they are alike.

To mark out the center bed and path.—

Use a garden line, a rake and the permanent stake that was placed in the middle. Make a loop in the end of the garden line and slip it over the center stake. Make another loop in the line four feet away and put the rake handle through this loop and describe on the ground a circle four

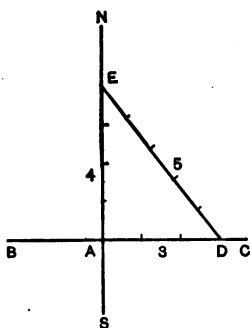


feet in radius. This is where the center flower bed is to be. Another shape, same plan. Model Children's Garden of the New York University. 122 ft. long x 50 ft. wide. Has 56 plots each 4x8 ft., which occupy 96x34 feet

Make another loop in the same line eight feet from the center stake and describe another circle. This second circle outlines a four foot path about the center bed. *Do not allow persons to walk about the garden until the paths are outlined, and then to keep to the paths.* The earth packs only too quickly without walking on it.

The general surface of the garden is now to be looked over and corrections made in the grading. The paths should be graded for surface drainage. Every individual plot should now be gone over with the rake and put in perfect condition, with the center a little higher than the sides.

Description of how to make a right angle on the ground in the garden.— A is where the center is to be.



BC is a straight line, made by a garden line drawn taut.

D is three feet from A.

Have the end of a tape measure held at A and the nine foot mark held at D, grasp the tape at the four foot mark and pull gently until it is taut along A E and D E. The four foot mark or E will then be the apex of a right-angled triangle, A E D, with a base of 3 feet, an altitude of four feet and a hypotenuse of 5 feet.

Any multiple of 3—4—5 can be used, as 6—8—10, 9—12—15, etc.

This rule is used in building by many men who have never had enough school study in mensuration to learn that "The square of the hypotenuse of a right angle triangle is equal to the sum of the squares of the other two sides." And very many children have studied this rule in school without ever learning how to apply it in real work.

Where a Children's Garden is maintained year after year on the same ground, the paths should remain fixed and the children spade their plots for each planting instead of having the whole area plowed or spaded. It results in better paths. Manure and fertilizer will then only be placed on the portion to be planted, resulting in a considerable saving.

CHAPTER XIII

THE FENCE

Wherever possible it is wise to have a fence to shut out stray animals. It also gives the moral and legal suggestion, that within is property valued by the owners, which they want protected.

The old English ideal of a fence or hedge was horse high, bull strong and pig proof. This is a good description of a really protective fence—one that a horse cannot jump over, a bull break down, or a pig root under.

For the average Children's Garden a fence forty-two inches high will keep out ordinary stray animals and allow people to lean on the top comfortably and watch the children at work.

A satisfactory fence is made with four by four inch posts set eighteen inches deep, six to eight feet apart. A ten inch bottom board set well into the earth. A middle rail, and a top rail, the latter laid flat. The spaces between closed with wire netting. One gate is enough. The fence should be tight all around. Use planed lumber. For this kind of fence the cost for material is about \$.20 a running foot.

It is wise to paint the fence and give the post ends and lower part of bottom board a coat of tar before

setting. It is feasible to have this fence made in sections and taken up in the fall and stored for the winter. In some places this is necessary to avoid destruction of the fence.

If loose chickens infest the neighborhood a higher fence must be built, of top and bottom boards and tall posts. The whole covered with wire netting. The height of fence depends on kind of chickens; for heavy fowls, six feet high; for white leghorns, eight feet or more.

CHAPTER XIV

WINDBREAKS

Steady winds blowing across the garden will often take away a great deal of moisture from the soil and stunt the plants. Hedges and other protection against the wind will be a great help, and will protect the surface of the ground for a distance of ten to twenty feet, for every foot in the height of the fence. All the old Dutch and English gardens are surrounded with hedges, which break the force of the wind in the garden. The amount of water saved in this way can be roughly estimated by this small experiment:

Take a pail and a plate, and fill the plate full of water and put the same amount of water into the bottom of the pail. Measure the amount of water and then place them side by side in the garden exposed to the same conditions as the plots. *Each twenty-four hours measure the amount of water left* in both the plate and the pail, noticing which evaporates the faster and how much faster one evaporates than the other. If the water in the pail stays longer than the water in the plate it is because the sides of the pail protect it against the wind. This will be a good lesson in windbreaks.

This experiment can also be tried on the window sill of the school-room.

CHAPTER XV

POINTS DESIRED IN VEGETABLES IN A CHILDREN'S GARDEN

Strong, sturdy, healthy growers, which are large enough for the table in a few days. Which make bright, clean, well-colored foliage. The root crops to make well-shaped beets, radishes, turnips or whatever they may be, with few side roots. Tell your seedsman how many days you have to mature a crop, from planting to harvesting, and he will suggest what vegetables and flowers and what varieties are most suitable. For the northern and middle states the following vegetables fill these conditions:

Radish	Scarlet Globe	17 to 25 days
Beans	Refugee 1000-1	55 to 65 days
Beets	Detroit Dark-red	70 to 90 days
Turnips	Strap Leaf White	70 to 90 days
Carrots	Early French Forcing	80 to 90 days
	Danvers Half-Long	
	Stump	100 to 120 days
Onions	Portugal (White)	
Lettuce	Black Seeded Simpson	70 to 80 days

Corn	Early Cory	60 to	80 days
	Golden Bantam	70 to	90 days
Kohl-rabi	White Vienna	50 to	65 days

If these are planted by the middle of May, near New York City, they can be all harvested by the end of July and include a second planting of radishes.

If the garden work stops during the school vacation (July and August) have the children plant as soon as the ground is dry enough (April 1st to 10th). Use radish, beets, carrots, onions, lettuce and kohlrabi, of the varieties named. These can all be harvested by June 30th, and the plots spaded and left in order for the vacation. For a School Garden south of New York during the fall term kohlrabi, radish, lettuce and turnips can be planted the first week in September. For time of planting add or subtract one day for each ten miles north or south of New York City.

It is always well each season to plant small samples of other standard varieties in observation plots. In this way you will soon become familiar with those which give the best results in your locality.

CHAPTER XVI

SEEDS

In considering the question of expense in planning for the garden, it is not economy to purchase low-grade seeds. The total cost per plot is small for good seeds and when you consider the labor, time and money spent in every step of the work, it is wise to obtain the very best seeds.

What are good seeds? Those showing a high percentage of germination, usually over ninety per cent, and that are true to name or variety.

What are clean seeds? Those that are free from foreign seeds, either weeds, other vegetables, or trash.

What are fresh seeds? Those grown the previous year.

Seeds that have been grown under good conditions, well ripened, properly harvested and stored, always look better, plumper and brighter. Sometimes seeds are harvested and offered for sale that have not fully matured, or have been improperly stored. Heat and moisture cause them to germinate slightly or ferment or mold. Sometimes an insect eats the germ. Most seeds lose their vitality after a few years. Carefully look them over. Test their vitality in the germinating

box. Buy standard varieties from reliable dealers, and obtain your seeds in time to replace them if they do not come up to a proper standard when tested.

When possible buy seeds in bulk and ask for the best discount allowed. Seedsmen will do the best they can to give fair prices. They want the trade. The nature of their product does not allow them to guarantee results and this fact causes them to strive for a good reputation, and protect that reputation by doing all they can to sell good seeds. But also remember that they do not grow all the seeds they sell. They buy from growers all over the country.

Testing.— In making a seed test for percentage of germination, use one hundred seeds, taking everything just as it comes from the package (including pieces of trash). Do not pick out the good-looking seeds only. Then make note every twenty-four hours how many have sprouted, according to the kind of seed and the time it takes to germinate. This test should last from one to three weeks. From observation during the test try to determine how many show strong or weak viability (power to grow). Get a fair idea of the temperature conditions under which the seeds are germinated. It should be about 65–75 degrees F., with sufficient moisture and fresh air and darkness. Seeds will often germinate in the favorable environment of a seed-testing box when their vitality is so weak as to be unable to withstand the actual out-door conditions of the soil. So try to understand what you are doing in making a test and learn to read the results so

as to apply the information gained to the probable results in the open ground.

An ordinary test can be made with a piece of cloth or blotter in a plate. Wet it, sprinkle the seeds upon it, cover with another cloth and plate and keep in a warm room.

To find the quantity to plant per eight foot row.— Mark an eight foot stick with inches. Lay it on the floor or table, and place the seeds along it, at the distances to be planted. Then weigh or measure the seeds. Multiply by number of plots in the garden. Some seeds are sold by the pound and some by the quart.

Amount of seeds per 100 foot row.

Seedman's usual estimate.

Beans	1	quart
Turnips	1	ounce
Kohl-rabi	$\frac{1}{2}$	ounce
Radish	1	ounce
Beets	2	ounces
Carrots	$\frac{1}{2}$	ounce
Lettuce	$\frac{1}{2}$	ounce
Onions	1	ounce
Corn	1	pint

CHAPTER XVII

THE PLANTING

Tools for planting.

Hand carrier containing wide-mouthed bottles filled with seeds to be used.

Hoes.

Marking board.

Watering pots.

Hand carrier containing empty flowerpots, with paper in bottom of each, for collecting left-over seeds.

The following rules are to give speed and accuracy in handling a large number of children. Each child is enrolled and given a tag, which bears its name and address on one side, the name of the garden and the number of the plot on the other. To this tag is fastened a strong string by which to hang it about the neck.

When about twenty-five children are ready, they are led into the garden by an instructor, and *warned not to talk* but to *look intently* at what the teacher is doing. If there are adult assistants, *they must be specially warned to preserve silence and strict attention*. Just before the class comes into the garden to receive the lesson, some large child or assistant marks each plot with the marking board and lays upon each



Enrolling for a "Farm." DeWitt Clinton Park

plot to be planted, a hoe, or a rake (or a stick, if there are no other tools), to be used in making the furrows. The plot stake *can* be used. Near the plot on which the object lesson is to be given the instructor should have a small hand carrier containing bottles, each holding a separate kind of seed.

The instructor then picks up the tool on the plot and draws light furrows. Beginning at the mark at one end and making the furrow about to the center of the plot, and then from the corresponding mark at the opposite end drawing a line nearly to the mid-

dle, making a very shallow furrow. About one-half inch deep is sufficient for most of the seeds and after



Putting on tags. DeWitt Clinton Park

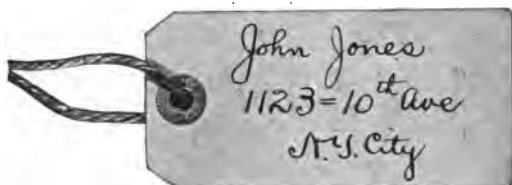
all five furrows have been made the furrow in which the beans are to be planted should be gone over and made about one inch deep. The tool is then laid down



The tag, front view

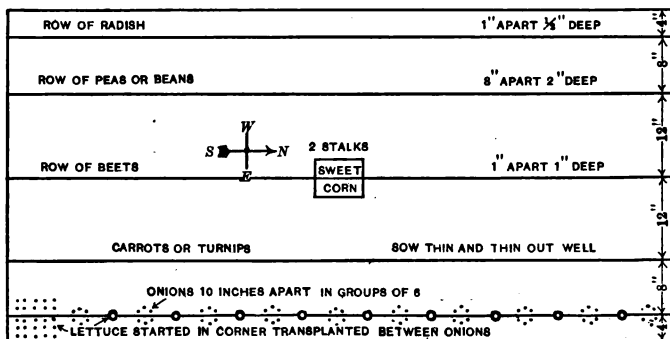
between the furrows upon the plot. Beginning with the bottle containing the radish seed, the instructor pours into the left hand enough seed for the row,

and plants with the right hand, taking between thumb and finger a few seeds at a time and sprinkling them thinly in the row. He replaces in one of the flower-



The tag, back view

pots any seeds left over. He then plants the beans eight inches apart in the second furrow, replacing any left over in another flowerpot; he repeats with the beets in the middle row about one inch apart; then



H.G. Parsons, 1930

Child's plot, showing details

with the carrots, sprinkling them very thinly in the next row; in the last row about ten inches apart he drops a small pinch of onion seed, from six to twelve in a place, and covers them with half an inch of

earth, pressing the earth down with the palm of the hand. In the corner of the plot at one end of the onion row he then prepares a level smooth surface about ten inches square for the lettuce seed. He then takes a small pinch of lettuce seed between thumb and finger and sprinkles this on the prepared place



Instructor planting radishes. Note the left hand holding seeds while planting with the right hand. Also the evident silence and close attention of the group. DeWitt Clinton Park

and covers it very lightly with earth, which has been made fine by rubbing between the hands, and presses this down with the palm. He should now cover the seeds with fine earth in proportion to their size. The smaller the seed the thinner the earth cover, and the more necessary to have the earth fine that covers them. One-half inch is enough except for the beans, which

should have about one inch. The earth covering the seeds should be pressed down firmly upon them.

Last, using for a measure the rake, hoe or stick used to make the furrows, he finds the middle of the center row (where the beets are planted) and puts in four kernels of corn about one inch apart, and pushes down with the thumb to the first knuckle (one inch).



Children making furrows. DeWitt Clinton Park

This is the lesson as given by the instructor, and there should be no delay from this point, until the children have begun to repeat the lesson on their own plots. Each child has on its tag the number of the plot he is to plant.

The children are now told to go at once to their respective plots and stand at attention behind the stakes. When all are in place at a signal from the instructor each child picks up the tools on the plot

and makes the furrows as the instructor did in the lesson.



Passing the seeds to the children. DeWitt Clinton Park

Just at this point is where the *assistants must be careful not to interfere unless some child really needs help*. If the children are using tools, as soon as the furrows are made, they should lay these tools on the



Children planting. DeWitt Clinton Park

plot between the furrows. If using the plot stake, it should be carefully replaced in the hole it came out of. The children then stand at attention, waiting for the seeds to be passed.

The instructor or assistant passes the seeds, in the same order used in the object lesson, beginning with the radish, going from child to child, and pouring



Filling watering pots. DeWitt Clinton Park

out of the bottle a quantity estimated to be enough for the row. These should be put into the left hand of the child. It is better to take hold of the child's hand and form it into a cup while pouring out the seeds, to avoid spilling.

If the soil is in a moist condition, no watering is required at the close of the planting, but if it is quite dry, it is well to water the plots thoroughly, using

care not to wash out the seeds. If the children have watering pots and a supply of water, they should put on this four by eight foot plot about fifty quarts. Some soils do not take up the water rapidly, and some children do not distribute the water evenly over the plot, and especially over the rows where the seeds are. In such cases it is well to tell the children



Watering after planting. DeWitt Clinton Park

to water until the whole plot is puddled. If the soil is quite dry and it is not possible to water after planting, special care should be taken to press the earth down very firmly over where the seeds were covered. This will help to bring the moisture up to the seeds.

If the children are to keep a record of their garden

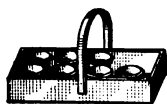
work, they should now be given their diaries and while right beside their plots make an entry. The instructor may suggest for this first day, when they do not know just how to begin, that they put in the date, the condition of the weather, the names of the seeds planted, and then they should leave the garden for the day. If there are many classes to plant, do not begin the diaries until the next day.



Writing up the diaries. DeWitt Clinton Park

In handling large numbers of children they should be told not to ask questions this first day, but attend strictly to the business of getting the seeds into the ground quickly and properly. After this first day the children should be encouraged to seek by observation and questions all the information they desire about the things in the garden. If because of a drying breeze, lack of rain, or perhaps a soil that dries very quickly, it may be wise to water the lettuce and onions, and perhaps the radish row a little every day until they are above ground. But, after this the children

should be taught that it is better for the plants to be watered with *much water seldom* rather than a little water often. On a four by eight foot plot fifty quarts of water once a week is worth much more to the plants after they are above ground than eight quarts daily.



Hand carrier
with flower
pots for col-
lecting left-
over seeds

In collecting left-over seeds there is danger of putting them in the wrong bottle. It has been found wise to use a hand carrier with seven small flowerpots. Place a piece of paper over the hole in the bottom of each pot, and then put a few seeds in each to show the kind. As these are passed the children can see in which flowerpot to put left-over seeds. After the planting these may be returned to the bottles.

If the seeds are not covered until placed in *all* the furrows, it enables the instructor to pass from plot to plot and correct errors in planting.

CHAPTER XVIII

OBSERVATION PLOTS

These plots are for decoration and information, and to furnish co-operative work for the children. What is grown in them depends upon the location of the garden and the demands made upon it. They can be arranged to supply subject matter of great help to teachers, and made to add interest for adult neighbors and visitors. Suggestions will be made for more plots than any one garden need have, so that selections may be made.



Public service. Care of flower beds

The observation plots divide naturally under several heads:

Flowers.

Garden vegetables.

Farm crops.

Special crops.

Weeds.

Experiment plots.

If these plots are kept cultivated and free from weeds until school closes in June, they ought to be in

good condition in September, when it reopens.



Each year grow in one of the best observation plots some desirable vegetable or flower not familiar in the neighborhood of the garden. This attracts attention, helps in the public interest and is often

Public service. Watering observation plots

the means of adding such a vegetable to the table, or such a flower to the garden of the homes of the neighborhood. It is surprising how few persons know such an estimable vegetable as kohlrabi. It is easy to grow and good to eat.

All of these plots can be decorative and should be plainly marked. Where the Children's Garden is

in a public place, these plots are a source of much interest to visitors. Very effective and instructive exhibits can be made with these observation plots. For example —

A plot of hemp.— To the left of the plot place a plain wooden chair. On the seat place specimens of manufactured products, and if possible, specimens



Photo by the Author

Public service. Hospitality to the city's guests. A visit from delegates to a play ground convention

showing progressive steps in the manufacture. Specimens mounted on cardboard can be tied to the back of the chair. This makes a very effective exhibit and history. The seed, growing plant, and finished product. This method commends itself as economical, easily arranged and quickly put away. It can be done with different plants as they approach maturity, or,

with a number in a general exhibit, regardless of the ripening of the plant. Each exhibit can have a list of



Photo by Mahoney

Public service. A visiting grammar class

things for which the plant is used, and a statement from the last Government Report of the quantity produced in the United States and by the world.



Photo by Mahoney

Public service. A visiting training class

EXAMPLES FOR EXHIBITS AT CLOSE OF SCHOOL IN JUNE.

Oats: Seed with hull — without — box of breakfast oats.

Wheat: Seed, bread, rolls.

Human use

High-grade flour

Low grade flour

Stock use

Wheat bran

Wheat shorts

Wheat middlings

Wheat screenings

Rye

Barley

Macaroni wheat

} similar

Flax: Seed — different steps in manufacture of linen.

EXAMPLES FOR EXHIBITS IN SEPTEMBER.

Field corn: Seed — ear — various feeds — corn bread.

Human use

Corn meal

Cornstarch

Laundry starch

Hominy

Corn syrup

Glucose

Canned corn

Stock use

Corn meal

Gluten meal

Germ meal

Grano gluten

Hominy chops

Glucose meal

Jute: Seed — fibre in manufacture — products.

Tobacco: Seed — leaf in manufacture — products.

Broom corn	}	similar
Hay		
Cotton		
Tomato		
Potato		

FLOWERS.

Ageratum
Alternanthera
Alyssum
Aster
Balsam
Bean { Japanese Hyacinth
Scarlet runner
Begonia
Calendula (Pot Marigold)
Candytuft
Canna
Clarkia
Cockscomb
Coleus
Columbine
Coreopsis
Cornflower
Cosmos
Dahlia
Eschscholtzia
Four o'clock
Geranium
Gladiolus

Goldenglow
Gourd vine
Heliotrope
Hollyhock
Honeysuckle
Iris
Lilies (various)
Madeira vine
Marigold (African)
Moonflower
Morning-glory vine
Mignonette
Nasturtium
Pansy
Pea (sweet)
Phlox
Pink (hardy)
Portulaca
Poppy
Rose
Salvia
Santolina
Snapdragon
Sunflower
Verbena
Vinca
Wallflower
Zinnia

GARDEN VEGETABLES.

Beans (pole, and snap)
Beets
Brussels sprouts
Cabbage
Castor plant
Cauliflower
Celery
Celeriac
Chard (Swiss)
Chives
Carrot
Corn (sweet)
Cucumber
Eggplant
Horse-radish
Kale
Kohl-rabi
Leek
Lettuce
Mangel-wurzel
Melon (musk, and water)
Mint
Okra
Onions
Parsley
Parsnips
Pea (garden)
Pepper

Potato (white, and sweet)
Pumpkin
Radish
Radish (giant)
Rhubarb
Rutabaga
Salsify
Spinach
Squash (hubbard; summer crookneck)
Strawberry
Tomato
Turnip

FARM CROPS.

Alfalfa
Barley
Buckwheat
Clover (red, white, alsike, mammoth, and crimson)
Corn (field)
Grasses (hay)
Millet
Oats
Peas (canada, and cow)
Rye
Vetch
Wheat

SPECIAL CROPS.

Corn { broom
 { pop
Cotton

Flax

Hemp

Herbs

Hops

Jute

Peanut

Rice

Sorghum

Tobacco

Wheat (durum)

CHAPTER XIX

WORK AFTER PLANTING

Dont's.	Insects.
General cleaning up.	Birds.
Planting of observation plots.	Transplanting lettuce.
Cultivating stick.	The first radish.
Garden lines.	Thinning beets and carrots.
Sawdust boxes.	Watering the plants.
Earthworm box	Care in every detail.
Sprouting plants.	Two stalks of corn only.
Weeds.	Fixing the plot after harvest.
Using the cultivating stick.	Cover crop.
Path making.	Sod borders.
Getting familiar with the seeds.	

Don'ts.—*Don't* cultivate the plots until the vegetables are up enough to mark the rows.

Don't straighten the small paths until the vegetables are up enough to mark the rows.

Don't cultivate with *tools* nearer than within two inches of vegetables.

Don't water after cultivating.

Don't water a *little* — put on plenty or none.

Don't work in wet soil with tools.

Don't throw weeds in the path — put them in a hand carrier.

Don't put extra plants in between the rows.

The inexperienced teacher may have the most difficulty the first few days after planting, because the children are all eagerness and no established work is under way. The first demand of the child is for active work.

Cleaning up.— Let them give the whole garden a general cleaning up.

Planting observation plots.— Have the observation plots planted. This may have to extend over several days, doing a few each day.

Cultivating stick.— Have the children each make a cultivating stick. This can be kept in the ground in front of the plot stake.

Garden lines.— They can also make the small garden lines.

Sawdust boxes.— Plant two or three boxes of sawdust with seeds like those in the children's plots. Have the sawdust coarse, thoroughly wet and about four inches deep. These can be left on the ground in the garden. During the following week, the seeds will sprout and the children can take them up and replace them as often as they like, and note development. It will satisfy their desirable curiosity and save their plots. The roots of sawdust-grown plants are clean and easy to examine.

When children see that plants grow a long time in sawdust, without earth, their attention will be roused as to where the plant gets its food, and they will be more easily convinced that the greater part comes from the air.

Earthworm box.—Start the earthworm box and give a few simple talks about what the earthworm does in preparing soil.

Sprouting plants.—When the children come into the garden each day, they will want to go first to their own plots to see what has happened since the last visit. About the third day they will probably find small cracks, and slight lifting of the soil directly over where the seeds are beginning to sprout, and in a very short time the different vegetables will begin to appear above ground.

Attention should be called to the special way which each vegetable has of coming up and the shape and color of the first leaves. This is especially necessary with such plants as the radish and carrot, whose second leaves are quite different from the first ones, and with the onions, which have an interesting method of coming up with the leaf doubled, and the bean, which lifts the whole seed from the ground, and seems to back out. If they are keeping diaries they should pick some of these first and second leaves and make tracings of them, and note the date of the first appearance of each above ground.

Some small weeds may come rapidly, and the children should be shown how to pull these, but warned

to be very careful and pay close attention to the parts of the plot where they planted, so as not to pull the young vegetables in mistake for weeds.

The intense interest of the children makes it easy for them soon to distinguish between the tiny vegetables and weeds, and the personal ownership of their plot adds very much to this strong desire to learn about everything that grows in it. Such work will greatly strengthen their powers of accurate observation, and this will be of much help to the teacher in all future work and study.

Weed plot.—In response to numerous questions from the children asking "Is this a good plant?" the teacher can start in one of the observation plots a weed bed, taking from children's plots a few young weeds, that are common in the locality, and transplant them. If the teacher will select those worth learning about, the weed plot will become an object of much interest. Of the many common weeds well distributed over the United States, the Department of Agriculture has made up lists and descriptions of those used for medicine, those classed as poisonous, and a number classed as troublesome to the gardener.

Weeds taken from the children's plots for this purpose will get more of their attention than if taken from the outside. It is well to limit the number to about a dozen. Interesting stories can be told about the great and constant war between the farmer and the troublesome weeds; and how we import from foreign countries large quantities of some of our com-

mon weeds for medicine. Many of these wild plants are edible, and, while not as good as our best garden vegetables, are well worth knowing about.

Using the cultivating stick.—By the end of the first week all of the vegetables should be up enough to mark the rows and the children can then do their first cultivating, using the cultivating stick, and loosening the earth between the rows to a depth of about three inches, and carefully removing all the weeds. Do not cultivate nearer than two inches to the vegetables to avoid destroying them, but the tiny weeds should be pulled with the fingers from the vegetable rows. If this is done when the weeds are small, before they have taken any substantial root, the labor will be very much less, and the vegetables in the plot will be much better off. In doing this work the children should squat in the path, face in the direction



Photos by the Author

Using the cultivating stick
with the right hand



Using the cultivating stick
with the left hand

they are working, and use the hand nearest to the plot, beginning at one end of the plot and working steadily to the other end. Then facing in the opposite direc-

tion come back on the same side of the plot and use the other hand. They will soon find that this is a very comfortable position and avoids leaning over and saves the small of the back. The position should be eased by standing up occasionally. The use of the cultivating stick not only will teach them in miniature how to use the hoe and make a dust-mulch, but also



Photo by the Author

Placing the garden line for a straight edge

bring their eyes close to the plot. *Watering should never follow this cultivation.*

Path making.— After the first cultivation the edges of the plot should be straightened, and for this purpose the child should use a small garden line so as to make straight edges and use the spade to cut the edge. The spade should not be allowed to cut very deep, not more than an inch, and the loose earth should be

placed either in the plot or in the center of the path, whichever needs it most. The path should then be



Twisting the garden line taut and pushing the stick well down to hold firmly

raked into shape with the back of the rake or it can be done with the spade itself, and ought not to be left until the child has thoroughly tramped the earth on the path as firmly as possible. The paths should be graded to carry off surplus water after heavy rains.



Photos by the Author

Trimming the edge, with the back of the spade to the plot

Getting familiar with the seeds.—The children should have frequent opportunity to examine seeds



Photo by the Author

Using the back of the rake to draw the loose earth to the center of the path

similar to those they have planted in their plots, to become familiar with each kind. They can do this by handling them (the sense of touch), by chewing a few (the sense of taste), by the odor (the sense of smell), and by cutting others open to see the inside (the sense of sight). They ought to become quite familiar with these seven seeds (radishes, beets, lettuce, onions, carrots, beans, corn). Have a set in small bottles kept in a box.



Like this

Insects.—Even in the midst of a large city the Children's Garden will soon draw insects, which will open up the whole subject of the insect in relation to the garden and in relation to our lives. The teacher should now make the same distinction with the insects which he did with the weeds, selecting for

insect study and observation those which are of economic importance. The Government Bulletins are a great help in making this decision.

Just as for the weed plot selection is made of those which are either useful or decidedly troublesome or dangerous, and which are common, so with the insect life, the teacher should select for the special attention of the children those which are either beneficial or else harmful enough to be of economic importance in our lives. For instance, there are some butterflies whose caterpillars never



Photo by the Author

Tramping it smooth, curved and hard before leaving it



Like this

do any damage to crops, but there are several which are a serious menace. A good example for instruction is the cabbage butterfly, because it is a widespread danger and very common, and because the teacher can obtain from the Government a good bulletin telling all about it. The same is true of the plant louse, and because the louse is a great enemy



Photo by Brown Bros.

Sprouting seeds in lantern chimneys



Photo by Brown Bros.

Studying insects in captivity

of our crops, its enemies should be classed as our friends, and, therefore, pay special attention to the lady bug, which eats up the louse.



Photo by Brown Bros.

Getting acquainted with aphids. Mrs. Henry Parsons and her little "farmers"

Another early and frequent visitor is the honey bee. It will sting, if its business affairs are interfered with, but it is an important friend for the honey it furnishes and for the work it does in fertilizing flowers, and it is a worthy object of study for the children.

Thus the division is made, and out of the multitude of things to which time and attention may be given in the garden, try and select those that will be the most valuable when learned.



Photo by Brown Bros.

Watching an insect at work

Birds.— Soon the birds will begin to come, even in a city garden — robins, thrushes, bluebirds, swallows and other feathered friends, and usually a great many English sparrows, whose friendly work is too often counterbalanced by the damage they do us. The Government will furnish all who apply with good bulletins telling of each of these, and there is so much of it that is interesting that the teacher should constantly put this test upon what he is going to teach: "Is this the

most important bit of knowledge for this child now?"

Transplanting lettuce.—As soon as the lettuce, which was planted in the corner of the plot, is about two inches high, it should be transplanted between the groups of onions, one plant in a place. In transplanting this lettuce care should be taken to make the instruction a model lesson so that children will have a clear idea of what should be done in transplanting all small plants.

First water the lettuce patch. With the cultivating stick make holes about three inches deep, one hole between each onion group, and large enough to receive the plants. Into the hole pour about half a cup of water. Then insert the cultivating stick under one of the small lettuce plants at the end of the row, and lift it carefully, retaining some earth, and taking care not to break the roots. Place this plant in the hole, and holding it with the thumb and two fingers of the left hand in such a way as to hold the small leaves together and keep earth out of the heart, with the right hand draw some earth about the plant, filling up the hole. With the thumb and first finger of each hand close together at the crown (which is where the leaves start from the top of the root), press the plant firmly into the ground. When finished, the plant should be set about as deep as it was when growing before, and should be in a very slight depression in the earth, so that when watered the water will fall toward the root and not away from it. If the plants are quite large when transplanted, about one-third of the leaf surface

should be pinched off, and great care should be taken to press the earth firmly about them in finishing the transplanting. The roots also should be straightened out in the hole and not doubled up in a knot. It may be necessary to transplant in the hot sun, or on a very windy day. In this case all plants that have been taken up for transplanting should be protected carefully against sun and wind, and kept cool and moist by wet covers until planted. After being set they may be protected during the first day *only*, by small covers of newspaper, or flowerpots. After the first day these covers should be taken off. Sometimes very young plants have to be protected in this way against flocks of sparrows.

After this transplanting there are usually a number of lettuce plants left in the corner of the plot, and a couple of weeks later these can be gathered while still small and will make a dainty salad of tender young lettuce. At the end of six or seven weeks the transplanted lettuce should be ready for harvesting. Gather one or two heads at a time and with them a few of the small onions.

The first radish is usually an event of much importance. The Scarlet Globe radish matures early. The brilliant red radish with its dark green leaves is a thing of beauty much prized by the children. The children should be taught how much better the quickly-grown, crisp, tender ones are than the tough, pithy ones. Radishes have been esteemed for centuries, and the knowledge so easily given the children here, will

induce them to give a small plot at home the proper attention in order to have a supply of this dainty.

Ancient history.—"How few know the antiquity and romance of the radish, its gradual change from a very large size to the small radish of to-day. In early times it was called by the various names Raphanus, Radicula and Radix, all meaning root, because it was written that it was one of the largest of the root crops. From these names we get the English name radish. The ancient naturalists give accounts of its culture in many parts of Europe, although it was not grown in England before 1548. Ovid (43 B. C.) mentions in his tale of Philemon and Baucis:

" 'A garden salad was the third supply
Of endive, *radishes* and succory.'

"The Greeks held it in very high esteem. In their offerings to Apollo in the Temple of Delphus, they offered turnips in lead, beets in silver, but radishes were presented to the god in beaten gold. One Greek writer (Moschus) devoted a whole book to the radish alone.

"The ancient Egyptians esteemed it for the oil made from the seeds. They knew of its antiscorbutic qualities, and also that its quality was improved by rapid growth, which they induced by the addition of salt-petre to the soil (the practical equivalent of our nitrate of soda).

"Both Pliny and Tragus state that they have seen radishes that weighed forty pounds; Amatus says sixty

pounds, and Mathiole assures us he had seen them as big as one hundred pounds.

“Very much later the French peasants roasted them in the ashes, and boiled them in soups for the flavoring. They also fed them to cattle. Roman physicians recommended them to be eaten raw with salt in the morning before breakfast, and they were considered excellent for dropsy and scurvy.



A nine and a half pound
radish

“The Romans admired radishes as a winter sauce to their meat, but it was observed that they injured the teeth, and yet says Pliny,

‘They will polish ivory, which is the tooth of an elephant.’

“Radishes abound with a penetrating, nitrous juice, which makes them diuretic and cleansing.”

Modern history.—The survivors of the mammoth radish of the ancients can be seen in the giant Japanese radish of to-day, which weighs from five to twenty pounds, and develops nearly half a bushel of leaves. However, most of our varieties are small and usually eaten raw. They are hardy, quick, and grow best in cold weather, in a rich soil. Hot weather makes them pithy. The radish is unknown in the wild state, having been cultivated as far back as there

is written history, and it may probably be the oldest known vegetable.

Thinning beets.— If the beets come up quite thickly, when they are about six to eight inches high, they should be thinned to four inches apart, and what is thinned out will be sufficient to make a very nice dish of greens. So many children have never known the beet leaves to be used for greens, that it is well to explain their value, so they will take them home to be cooked. If enough seeds were planted, the thinning from the eight foot row should give a good mess of greens (thin turnips and use tops the same way).



Photo by the Author

Thinning beets

In some sections of the country the beet tops are not used for greens, in other sections the turnip tops are not used. In the Children's Garden the use of both these and other vegetables can be taught and the variety and quantity of food increased. Repeated plantings can be made for the use of the top only, for greens. They can be grown when there is not time for root development. They are a valuable addition to the dietary. For this purpose the planting should be closer.

The carrots should also be thinned to about one inch apart, and those taken out can be used as parsley is, or for soup flavoring.

Watering the plants.—While it is desirable to water the plots early in the morning or late in the afternoon when the sun is not hot, it is not always possible. If the ground is watered in the hot sun, a good deal of the water is lost in evaporation. Under these conditions it is well for the children to water



Photo by Mahoney

Garden talk about the turnip

between the rows of their vegetables and hold the spout of the watering pot close to the ground near the bottom of the plants, and not sprinkle it all over the tops of them. Careful and constant cultivating, which keeps away weeds and maintains a good dust-mulch, will reduce the amount of watering necessary, and where it is difficult to obtain water the teacher should emphasize this. It will make very good object lessons to have several children give special care to what might be called miniature dry farming. That

is, very careful cultivation and perhaps some special protection against wind, and compare the results with those children that water their plots often. However, where it is possible to have water in the garden, it is wise to do so.

Care in every detail.—Because the child's plot is small and the rows are close together, it is important to have all the conditions for success attended to. In the beginning it was well manured, carefully spaded, raked fine, and the rows planted carefully and straight. Now it should be kept free from weeds, and well cultivated.

When thinning out plants, the children should be instructed to take out small, weak plants, and leave the largest and best looking. The purpose in thinning out plants is to give more plant food and moisture for the roots, and more air and sunshine for the leaves, of those that remain. If they are too close together they will not grow as we desire, and if too far apart space is wasted. The principle is the same whether it is one hundred acres or thirty square feet. We want each plant to have just space enough to do its best — and no more. And we must give it this space soon enough, and during its most active period of growth.

The corn should be thinned to leave two good stalks. Four or five kernels are planted to be certain to get two, but if all are left they will take too much food from the other vegetables. Corn is called a "vigorous feeder" and extends its roots wider than

the other plants. Be careful to remove the suckers, because they take nourishment from the ear-bearing stalk.

Fixing the plot after harvest.—When the time comes to harvest the last crop in their plots, whether it be in June or October, the children should spade the plots deeply, trim the edges neatly and leave the whole *orderly* and in *good shape*. All leaves and small stems not to be otherwise used, should be chopped up with a sharp spade and turned under in the plot.

Cover crop.—In many places it is wise to teach about cover crops and maintenance of humus, by sowing each plot with rye or clover at this time. This crop is to be turned under at the next spring spading.

Sod borders.—There are several places where the garden may have sod laid — a border about the center plot and edgings along the observation plots. The



Photo by Brown Bros.

Public service. Making a shelter for the gate

only objection is the extra care required. In many localities this objection is more than balanced by the lessons learned.

In New York City it costs thousands of dollars to keep in repair the sod edges in the parks, because the public is ignorant of the cost and careless of public property.



Public service. Painting the hydrant

Here the children see how much beauty is added to



Photos by the Author

Public service. Ditching to drain a wet spot

the garden by the sod border, and in preparing the soil, laying the sod, keeping it trimmed and clipped, they learn the cost in time and labor, and begin to appreciate the wrong to themselves by vandalism in the parks.

These edgings may be from eight to twelve inches

wide. The soil should be spaded and raked fine, the sod laid carefully and level, and then pressed or pounded down firm so as to get into close contact with the soil. It should be thoroughly soaked every few days until rain comes, when it will probably take hold all right. Use lawn mower or shears for clipping. This instruction will teach the children how to do the work in improving their own home surroundings.

EXCERPT FROM REPORT OF CHILDREN'S SCHOOL FARM
IN DEWITT CLINTON PARK, NEW YORK CITY, 1905,
SHOWING LESSONS PLANNED AND TAUGHT BY THE
AUTHOR DURING HIS CONNECTION WITH THIS CHILDREN'S GARDEN.

Summer of 1905 — Lessons Taught.

Theoretical Talks.

Private care of public property, citizenship. Attitude of the citizen of the garden toward the visitor to the garden. Individual rights vs. Community rights. Power of co-operation. Dignity of Labor

The Hoe — Its history and evolution

Spade

Spading fork

Rake

Sieve

Garden Line — How to make straight lines. Curves and angles. Tape measure.....

Practical Work.

Theories put into excellent and noticeable practice in the new park.

Used in everyday work.

Spading and path making.

Spading in manure, etc.

Raking garden and paths.

Separating trash from soil.

Making paths and plots.

Theoretical Talks.

Wheelbarrow — Principles of loading and using.....

Water pot

Handweeder

Trowel

How to tie some useful knots....

Soil — What it is. How it is made. Some different kinds. What it supplies to plants. Cultivation of soil. Mulches and their use. Soil drainage. Water in soil. Air in soil. Warmth in soil...

Manure — What it is. Why we add it to garden soil. Draws and holds moisture. Adds warmth and plant food. Carries weed seeds. Increases soil ventilation. Makes acids which break up minerals from which come plant food

Seeds — Inside and outside.....

Below Ground — Roots. How they grow. How they differ from stems. Some underground stems. Above Ground — Stem. How they grow. How they differ from roots. Some over ground roots..

Practical Work.

Wheeling manure, soil and rubbish.

Watering in sun and shade.

Weeding and loosening soil.

Transplanting.

Used in flag raising, doing up bundles, putting up clothes lines, etc.

Samples collected, and different points noted and talked about day after day in the children's own plots. Effect of different soil conditions noticed in growing plants.

A large quantity of manure was handled by the children. They wheeled it across the garden, spread four inches deep and spaded it in, on ground 30 by 250, as well as a bushel of it spaded into 356 other plots.

Besides regular planting of their plots, the seeds were dissected and sprouted for study.

Subjects for these talks were taken from children's plots and weed plots. Beets, etc., and grasses.

Theoretical Talks.

Practical Work.

Leaves — The plants' stomach, lungs, and general laboratory. Color and how affected by light. Wilting, etc.....

Water in growing plants and where it got in, and where it goes out. How much needed. What else plant gets from soil. How much per cent. What plant gets from air. How much per cent. Proportion of plant which came from each. Earth, air and water.

Beans and peas — Watching for the blossoms. Watching for the pods. Discovery of the nodules on the roots. Story of the nodules

Air — What it is. Mixture of gases. Names of the gases.....

Carbon Dioxid — Where it comes from. Use to plants.....

Oxygen and Nitrogen — Organic impurities in air. How rain washes the air. How we protect ourselves from wind and why. Importance of air to animals and plants

Water — What it is. No pure water in nature. All mineral food of plants must be dissolved and carried in by water. Impurities of water, minerals, bacteria. Decaying organic matter (dead animals and vegetables). Importance of water to animals and plants. How plants keep cool on hot days.

Sunlight — Color shown by prism. Purifying power of sunlight. How sunlight affects health.....

The information gained in these talks was fixed by observation in the daily garden work, and by simple experiments.

Names of parts.

Making wind breaks and shelters.

Cultivating to get air into soil. Thinning plants to get more air.

Watering the garden. Saving moisture by mulching. Ditching and raising plots to carry off water. Irrigating the garden. Weeding to save water.

Using a burning glass. Bleaching clothes by sunlight. Bleaching plants by darkness.

Theoretical Talks.

Warmth from sun.....

How leaves make starch under sunlight. How light affects color of leaves and children. Sunlight and air vs. washing.....

Insects — Friends and enemies.

Cabbage worm and butterfly. Plant lice. Tomato worm and parasites. Ladybugs and larvæ and many others, captured and mounted for study. Flies and maggots.

Practical Work.

Thinning plants to get more sun.

Planting rows north and south to get more sunlight.

Children learned to know a number of insects and captured and killed a great number of enemies, and when they learned of the use of the ladybugs, they caught them and put them on their own plots. Two insectaries were made by the children and butterflies and caterpillars kept in them and fed and watched.

Preparing seed bed.

Planting seeds.

Transplanting lettuce, etc.

Weeding.

Making paths.

Raking paths.

Watering plots.

Thinning vegetables.

Pulling vegetables.

Spading, using wheelbarrows.

Painting and numbering signs.

Cutting grass.

Laying sod, etc.

The children did all the work, and the majority proved quite capable. Only enough was done by instructors to get them started right.

CHAPTER XX

"REASONS FOR THINGS"

Why long rows.

Why rows run north and south.

Why plot size four by eight feet.

Why small path eighteen inches wide.

Why individual plots alike.

Why accurate measurements desirable.

Why finish individual plots when school stops.

Why these vegetables for child's plot.

Why five rows.

Why collect left-over seeds.

Why use sieves.

Why long rows?—The good farmer plants long straight rows for economy of labor. The arrangement of the plots, when looking north or south, shows long, straight rows of similar plants, and gives the same appearance as a well-planted field. In this way the child gets the proper mental picture of a commercial garden.

Why rows run north and south?—When the rows run north and south, the morning sun shines on one side of the plants, the afternoon sun shines on the opposite side. This gives more sunlight to each plant. If the rows run east and west the sun shines on one

side only of the plants, and a row of tall plants will completely shade the ground for quite a distance to the north of them for a large part of the day.

Why plot size four by eight feet?— The size four by eight feet has been found to furnish enough work



Photo by Mahoney

Showing the long rows, looking south. The cross paths do not show

for the average child, to develop individualism and to teach each step of the work, especially when it is desired to occupy a part of their time with other work and study in the many general things the garden offers, to develop co-operation and community interests.

The width allows the child to work the plot without walking in it, and yet have to stretch to work on the middle row. This occasional stretch is good physical culture. This size plot will furnish enough vegetables



Photo by the Author

A good stretch, well balanced

to excite and maintain interest.

Why small path eighteen inches wide?—The eighteen-inch-wide path surrounding each plot is wide enough to allow the child to stand, squat or even

lie in it while at work, but it is not quite wide enough to allow any carelessness. Because the child is a property owner it does not desire to damage a neighbor's garden, and the limitations of this path enforce careful movement to avoid damage.

In the olden days "landless man" meant "lawless man." The underlying reason is true to-day. When the child becomes a property owner its respect for property rights begins.

Why individual plots alike?—The individual plots are all alike to simplify the work of the teacher. A lesson given to a group applies to all. This item grows in importance as the number of children, per teacher, increases.

Why accurate measurements desirable?—Accurate measurements in the beginning simplifies all the suc-

ceeding work of the instructor, in setting and checking up work for the children. Interchangeable parts are a great economy in machinery. The same principle is true here. The measurements of each child's plot and path should be the same, so that the work, problems and instruction apply to each.

Why finish individual plots when school stops?—
If the garden with individual plots is part of school



A lesson in thinning carrots given for one boy's plot applies to each of the group

work, it should be planted and harvested during the school session. The essence of purpose in a Children's Garden is the best good of the child, and what good for the child is not understood in a school where the children leave their plots at the end of June without harvesting the crop and leaving the plot spaded and in order.

The simple lessons about the soil and plant growth

can be illustrated with radishes if the time is very short, and quite a number of vegetables are available if there are three months of growing weather. To preach neatness and thrift, and illustrate it with neglect is poor pedagogy, and borders on immorality. There is no more reason for growing in the child's plot, a vegetable that cannot be harvested until August, when he is to leave it in July, than there is for growing apple trees that take eight years, or pine trees that take sixty years. This does not apply to the observation plots for they may have crops that can be harvested when school opens in September, and may well have plants that last from year to year.

Why these vegetables for child's plot? — The vegetables suggested grow in a short time, are low so as not to shade other plots, are hardy, common, well shaped, bright colored, fine flavored, and represent several botanical families.

Radish	Mustard family
Beans	Legume (pulse) family
Beets	Goosefoot family
Carrots	Parsley family
Lettuce	Composite family
Onions	Lily family
Corn	Grass family

If it is desired to discuss botanical relations some of their relations are, viz.:

<i>Radish</i>	<i>Mustard family</i>
(Weed)	Charlock
(Flower)	Sweet alyssum

(Vegetable)

Garden cress
Water cress
Mustard
Horse-radish
Turnip
Rape
Cabbage
Kale or borecole
Kohl-rabi
Cauliflower
Broccoli
Collards
Brussel sprouts

Beans

Legume family
(Pulse family)

Locust trees
Wisteria vines
Clovers
Alfalfas
Vetches
Peanuts
Peas
Beans

Beets

Goosefoot family

Beets
Swiss chard
Mangels
Sugar beets
Spinach

(Weed)

Pigweed or lamb's
quarters*Carrot**Parsley family*

(some wild forms are poisonous)

Carrot

Parsley

Parsnips

Chervil

Dill

Fennel

*Lettuce**Composite family*

Burdock

Thistles

Chicory

Dandelion

Wild lettuce

*Onions**Lily family*

Garlic

Leeks

Chives or Cives

*Corn**Grass family*

Bamboo trees

The hay grasses

Wheat

Barley

Rice

Maize

Broom corn

Rye

Oats

Millet

Sorghums

Why five rows? — The five rows lend themselves to a form and color scheme that is very attractive — the center row, a red-leaved beet; the other plants, by their leaf shapes and shades of green, give a most beautiful effect, that is much enhanced by the long rows.

Why collect left-over seeds? — The left-over seeds are collected not only because they are worth saving, but especially for the effect on the children. The great value of gardening is that every part of the work can be made to teach good lessons. Without preaching, the normal right practice of good gardening makes habits of the homely virtues of thrift, economy, planning ahead, timely work, orderly methods and seeking for more knowledge.

It remains for the good teacher to suggest more general application in the life outside of the garden, and especially to start the child thinking before twelve years of age.

Why use sieves? — To train in habits of saving and thrift, and develop a belief that good soil is valuable. Every time trash is raked into a pile and then shoveled into a wheelbarrow or hand carrier for removal, there is apt to go with it a few quarts of the best top soil.

If the trash and soil are separated with a coarse sieve, the soil can be returned to the garden, and often the trash can be better sorted and some value found in it. The separation of refuse for better disposal and perhaps further uses is only neglected by the ignorant and thriftless.

Have the children sort the refuse of the garden and turn each kind of material into the proper channel for further use. It is a form of wealth which our intelligence should put to work. When separated, the good soil can be returned to the plots. The grass, leaves, straw and similar matter that will easily decay, goes into the compost pit for future humus; pieces of wood, knots, and stumps to be burned for the ashes to be returned to the soil. Clean stones, coal ashes, brick, and similar material for paths and fills. Without this separation all are useless for any purpose, and even costly to dispose of.

There are some weeds that not only live, but thrive under conditions where others die. Go to the weed plot and study out the reason. At every joint, where they touch the ground they draw nourishment. From many points they are supplied, and they never neglect an opportunity to add still another.

If man neglects to teach his children this kind of Nature-study, he will continue to wonder how poverty shall be relieved. Learn to seek income on every hand, and form habits of turning little things to usefulness.

CHAPTER XXI

SUNLIGHT

In trying to instruct children about some of the natural forces, our limited knowledge and our limited command of words frequently makes this subject a difficult one, but when we remove the place of instruction from the class-room to the garden, the teacher can make use of object lessons, which will more effectively instruct and oftener tell the truth. Scientists tell us that only plants are capable of taking up carbon, oxygen, phosphorus, potassium, nitrogen and other necessary elements and changing them into such combinations as will make organic matter, that is, matter capable of life, and that therefore, plants directly or indirectly furnish all the food of the world, for animals must either eat plants or else eat other animals that have eaten plants. They also tell us that this wonderful power of plants to do this can only be accomplished in the light of the sun, and, by a number of simple experiments in the garden, it can be shown that unless the plants have sunlight, they cannot live and perform this very necessary work. If seeds are planted in the ground and the sunlight shut away from them, they will attempt to grow, but will soon die. They must have also a certain amount of sunlight

suitable to them, and by experiments it can be shown how much sun they need. If they do not have enough they are pale. Shutting off the sun from some plants takes away their health, so they are not able to properly develop. Plants like the tomato, if grown in a place where they cannot get enough sun, will not bear fruit. These experiments prove that each different kind of plant, animal, and insect life need special amounts of sunlight to get their best development, and therefore the garden must be so arranged as to give the plants sufficient sunlight to obtain the best results. All the leaves of plants have a green coloring matter (chlorophyll), which is necessary for the plant to do the work of combining the chemical elements. When the light is taken away the leaves lose their green color, and they are no longer able to live and work.

Sunlight supplies the plant with water by making the rain. Sunlight warms the soil. When it has been determined how much sunshine a certain kind of plant needs, it can then be decided how far apart to place these plants so as not to shut off the sunlight. Some sections of the country have more sunlight than others, and this fact has made it possible for one part of the country to produce a great proportion of our Indian corn, which needs much sunlight. Scientists tell us that almost all the work of the world is done with power obtained from the sunlight. It raises the water in clouds, and then makes the wind, which blows these clouds inland, where rain falls and produces moisture for the farm, the forest, and the

rivers, for navigation and power. Sunlight in bringing the moisture from the ocean back to the land, separates it from the salt and other minerals, and brings it back to the plants in the purest and best form for them. In growing plants, there must be a good soil with the necessary food elements, but only with the aid of sunlight can the plants make use of their food. From this we learn that sunlight maintains life.

Too much sunlight is a destroyer of life. There are certain forms of life which have become used to living with very little light, and if they are suddenly brought into continued bright light, they die, and fortunately for us, both the animals and the plants, which we desire most, are able to stand a great deal more sunlight than many plants and animals which are dangerous to us. Therefore, it is very important that we should learn all we can about this wonderful power in the sunlight, and



Photo by the Author

Teaching sanitation with turnips. A 3-foot tube (a tile); an 18-inch tube (tin pipe); a 6-inch tube (tomato can); a complete cover (wooden box). Covers left on seven days.

make use of it to increase our strength and happiness and drive our enemies away from us.

The children's attention can be called to the fact that people who seldom go out in the sunlight, those whose work keeps them in the house or the factory, or the mine, are usually without the ruddy color of those who work much in the sunlight, like farmers and truck drivers.

The children can put covers over three or four of



Photo by the Author

Uncovered. The turnips were pale; diseased; decaying; or completely gone in the proportion covers shut off sunlight and air for seven days

the plants in such a way as to shut off different amounts of sunlight, having one cover shut off very little, one cover shut off at least half, and one cover shut off all the sunlight. These should be left about six or seven days, and the plants then

examined. They will find that the plants have grown pale and sick-looking, just in proportion as the sunlight was cut off. When they lift up the cover, which shut out all the sun, they should approach it carefully and

remove it quickly, so as to surprise the insects and worms which have gathered there.

This is one of the great lessons, with a simple illustration, that much disease and many insect pests thrive in semi-darkness, and then attention can be called to the fact that many diseases and insect pests of men



Photo by Brown Bros.

Teaching sanitation with lettuce covered to shut off two-thirds of light and air for ten days

come in the darkness. The doctors tell us that almost all of the germs of our serious diseases will be killed by sunlight, and we know that many of the household insects that bother us are liveliest in the dark.

It will be interesting to give up one observation plot entirely to experimenting with plants to learn how much space they need. Mark the plot with furrows twelve inches apart. Use a quick-growing radish or turnip. Plant one row very closely together,

say six seeds to the inch; one row, the seeds a foot apart; and one row with the seeds one or two inches apart. Thus determine what is the best distance without taking somebody else's word for it.

This kind of experimenting is excellent for the children. It teaches them how to find out things for



Photo by Brown Bros.

Lettuce uncovered after ten days. Very pale and weak. So much resisting power gone that after uncovering, one day's hot sun destroyed them completely. Note the hardy plants in the foreground. They were alike ten days before

themselves, and this the teacher should strive to do, so that when the child leaves school, he will be able to continue teaching himself.

Many plants that bear flowers and fruits, and nearly all of our garden plants that do so, require more sun to produce the flowers and fruit than those which grow only leaves, and it will be good experiment work to

take samples of three or four kinds, and grow them in the sunniest and shadiest places, and note the results. Try tomato, which likes heat and sun; pea, which likes cool and sun; and bean, which likes heat and sun.

On the other hand, ferns, which naturally grow in the shade of the woods, will not do at all well if planted in the sunniest spot of the garden. Mint and horse-radish like shade, dampness and coolness. All these experiments should be made in special observation plots, and carefully planned to get the results desired. Do not sacrifice the child's plot, either in looks or product, to do these experiments. Teach the children the proper methods for success in their plots, and show the evil results of improper methods in observation plots.

The experiments to show how different plants act in different amounts of sunlight, should be made as simple as possible, and so plain that the results will speak for themselves. From these simple experiments, the teacher can draw some very practical lessons to be applied to the child's personal health.



CHAPTER XXII

AIR

Nine-tenths of all the dry matter of plants comes from the air. This is a very important reason why we should be careful that the plants have all the air surrounding them that they need. If their air supply is cut off, their food supply is lessened, which, of course, will affect their growth. If plants are separated sufficiently for them to get enough sunlight, there usually will be enough air. Some experiments can be made in the garden to show the effect on plants of shutting off their air supply in different amounts.

Instead of dark covers, such as were used in the sunlight experiments, use covers of glass which will let the sunlight through, but which will stop the air supply. One cover can be a glass lantern chimney, which will have a large opening at the top, which will admit a good deal of air, but will stop the air from blowing around the plant. Another cover can be a fish globe or a milk bottle, and this will shut off practically all of the air without shutting off the sunlight. The children can then watch these plants for a week or more, and see how they act when they have plenty of sunlight, but not enough air.

The air is made up of oxygen, nitrogen, water,

carbon and several other materials. It wraps the whole earth like a big blanket to keep it warm from the great cold outside. It can be weighed and measured, and it presses in every direction about fifteen pounds to each square inch. It is this pressure that makes it possible to pump, or breathe, or swallow.

One of the important uses of moving air, is to carry away the moisture and the gases which the plants throw off, that is, to keep the plants well ventilated. If this ventilation is stopped, the result will be much the same as it is to people in a badly ventilated room. The plants will get droopy and tired looking, and the air inside of the bottles will become much too warm for them to grow well.

To illustrate the air pressure, take a glass tumbler, fill it full of water, and place a card over the top of it in such a way that there is no air left in the tumbler. Hold this card firmly against the tumbler and carefully turn it upside down. The child then will readily see that the pressure of the air upward against the card is great enough to support the weight of the water in the tumbler. This will illustrate the pressure of the air.

One of the ways the garden soil is ventilated, which means changing the air in it, is by the wind blowing over the surface. This takes away some of the downward pressure of the air, and when the downward pressure is removed, the air in the soil comes up, and when the wind stops, the full pressure is renewed, and the air moves downward again. This

gives a pumping effect to the air in the soil, and helps to keep it moving and changing around the plant roots. This can be illustrated by placing a small square of paper under the fingers, and blowing hard through one of the spaces between the fingers. While the blowing is continued, part of the pressure will be removed from the top of the paper, and the pressure of the air below it will hold it against the hand. As soon as the blowing stops, the paper will fall. Another way is to make a sucker. Boys are familiar with making use of the washer of soda water bottles by putting a screw through the hole, and sticking this against windows or walls. This, or a larger piece of rubber, may be used for this experiment, and by using one with several square inches of surface and slightly wet, and pressing it down firmly so that there is no air under it, quite a heavy weight may be lifted, and held so long as no air gets under the sucker. A piece of heavy glass will usually give the smoothest surface and best results, but a piece of old chinaware or tin plate will also serve. This can be held on the floor between the feet, and the children can try to pull the sucker loose. This will give them a very definite idea of how hard the air presses downward, when there is no air on the opposite side to press upward.

It is this air and the carbon in it, which the leaves and the sunlight make into the wood of the trees, and the flowers and fruits, and perfumes and beautiful colors of the plants.

The need for fresh air and sunlight does not seem

so strange, when we learn that most of the plant is made from air by sunlight. The strange part is that so few people know it. Stranger than this is the fact that with the knowledge so easy to obtain, human nature refuses to acquire it, or to make use of the knowledge when it is offered. We continue to kill off the babies and the children, who otherwise might make useful citizens, by surrounding them with conditions where they are absolutely prohibited the proper use of sunlight and fresh air.

We crowd our plants so as to shut off sunlight and fresh air, and they grow weak. They are pale. They will not bear proper fruit. In such mistakes we waste much of our time and energy, and grow poor. We crowd our people and their children into homes and streets where the air is filthy, where the sunlight cannot enter. They live in such conditions. They work in such conditions. Sickness, weakness, crime, deformities and death come as a perfectly natural result. It may be because of ignorance, but it is surely criminal ignorance.

In the garden we learn clearly the needs of plants for their best development, and through their lives can be taught the human needs.

CHAPTER XXIII

WATER

How the children can learn about water by watching it in the garden.— In the lessons about making the paths and about surface drainage, have the children visit the garden either in a rain or immediately after it. Let them notice the places where water flows and where it stands in puddles, and after a few storms, they will be able to see that the water in flowing over the surface and down hill, has a great power of moving the surface earth, also of sorting it out. By making a pile of earth two or three feet high, and pouring water upon it from a watering pot, or the hose, they can make a miniature mountain stream, and will see just how this sorting power of water acts. The finer the particles of soil, the farther away they are carried. The children will have an exact picture of how the delta is formed at the mouth of a shallow river, and of how serious floods can be on hillsides.

After watching rains in the garden, and noticing that puddles stand longer in some places than in others, they can examine the soil and find that where the water stands, the ground is not so loose and open. They will, in this way, learn the importance of the fact, that water runs downhill always, and they can

then make whatever changes are necessary in the grade of their garden, to either carry the water off better, or to stop it from running off so fast, whichever is desired, or perhaps, put in drains to relieve wet spots.

While the vegetables are growing, they use a great deal of water, which they take in through their roots, and which they pass out through their leaves. The children need not take this for granted, but can prove it in the following ways. Let them pick leaves from a plant, like the lettuce or the beet, and grind them up between their hands, and squeeze out a quantity of water. That the water is constantly passing up through the plant, can be shown by noticing that the leaves on the growing plants are stiff and stand upright, and if a plant is pulled out of the ground and laid in the hot sun, it soon wilts. This shows that the water is constantly leaving the plant. Pulling it out of the ground has cut off its supply of water. Many plants will revive and the leaves straighten up again, if placed in water, so the plant can take up some more. To show that the plant is constantly passing water out of the leaves, put a glass vessel over the top of the plant, and also pull some fresh leaves and put them under an inverted glass vessel, so that any moisture that comes from the leaves will not escape. These experiments are best performed in the sunlight. The moisture that comes out of the leaves will be collected on the inside of the glass.

The plants make a great deal of heat in themselves. This can be shown by picking half a dozen plants,

and packing them closely in a box, and shutting the cover down tightly to keep the heat in. In about 3 or 4 days, they will make so much heat that it will be easily felt by the hand being put in the package. The water that is passed out through the leaves of the plant carries off much of this heat, and keeps the plants cool enough to grow. That the water does carry away heat, can be plainly shown to the children, by having them wet one hand, and keep the other hand dry, and then rapidly swing both arms around in the air. They will find that the hand that has been wet, will become dry in a short time by swinging it around, but at the same time, the water that has left the hand, has carried away so much heat, that the hand that was wet, is now very much colder than the hand that was dry. They can then be allowed to take hold of dry stones, boards or tin cans that have been exposed to the hot sun, and compare them with the growing leaves of the plants exposed to the same hot sun. They will find that the leaves are very much cooler, and after the previous experiment, will realize that the leaves have been kept cool by the water that carries away the heat.

According to the age of the children and their grading in school, the teacher can either stop with such simple experiments as these, or can go into further detail, and consider how much water each different kind of crop needs each season, and how much heat is required to vaporize water. (Refer to King's

"Irrigation and Drainage," "Physics of Agriculture," and "Government Reports.")

Among other interesting experiments to learn how water acts, are to test the strength of a dry piece of paper, and then test the strength of the same paper after it has been thoroughly wet. Tie string tightly around a smooth stick, and note that wetting the knots makes it bind tighter.

The children may at first protest that the moisture that is squeezed by the hands from the leaves of plants is not water, but juice, and they are quite right. The teacher must then explain that the juice is made up of water mixed with other things which the plant has added. That this juice is different from pure water, can be shown in a very interesting way, which will appeal to everyone.

Put some grease on the hands. Gather fresh vegetable leaves, or grass, and wash the hands thoroughly with the juice. It will dissolve the grease, so that it will wash off with plain, cool water.

CHAPTER XXIV

THE SOIL

We want to tell the child something about soil. What it is made of; how it is made, and its use to mankind.

It must, indeed, be little at first, and we must make as much use as possible of eyes and hands to help the imagination. A few samples of rough and smooth stones, sand, clay, loam, and a magnifying glass will be a great help. Tell something of how rocks are broken by great forces exerted by heat, cold, water and wind. How glaciers ground the rocks and carried them along; how freezing water split them, and running water wore them smooth.

Break some of the stones, and compare the rock dust with sand and earth under the glass. Tell how the surface soil has in it decaying animal and vegetable matter, and how the falling leaves and dying grass add to it. How worms and burrowing animals mix these with the soil. How rains wash the fine surface earth into rivers, which carry it down stream to deposit elsewhere.

Keep the samples and the glass where they can be referred to, whenever the child wants to use them. Day after day, as you work together, tell a little

more, with, perhaps, something about the bacterial life constantly at work building and tearing down, and the chemical changes.

A fertile soil is composed of :

Fine ground rock.

Humus.

Air.

Water.

The rock of the soil contains elements needed for plant food, and these must be dissolved in water and carried to the feeding roots of the plants.

These elements are :

Nitrogen	Chlorine
Potassium	Sulphur
Phosphorus	Silicon
Calcium	Aluminum
Sodium	Carbon
Iron	Hydrogen
Magnesium	Oxygen

Humus of the soil is the decaying organic matter of dead animals and vegetables, mixed thoroughly with the few inches of top soil, making it darker colored. It is in the spaces between the particles of rock, and acts like tiny sponges in holding water. It fills up the too large spaces of a sandy soil, and separates the too close particles of a fine clay soil. It

makes a home and feeding ground for the countless bacteria necessary in a fertile soil. It has some of the purifying action of charcoal to keep the earth sweet. The finer it is, and the more thoroughly it is mixed, the more rapidly and completely does the rock give up its minerals to the soil water. This thorough mixture of humus gives the soil that crumbly texture so much desired.

Air of the soil supplies oxygen and nitrogen to assist in the chemical changes, and for microscopic life. As it moves about it ventilates the soil.

Water of the soil keeps the humus decaying slowly, and in a way that gives the best result for a fertile soil. When this water falls as rain, it washes from the air above, the carbon dioxide, ammonia and other gases. There is more carbon dioxide in the soil-air and the water takes it up. Pure water dissolves the rock very slowly, but with the carbon dioxide and humic acids, it dissolves much faster. The bacteria are always busy making new compounds which the water dissolves, when the plant roots can take them in. The water moving about in the soil also carries oxygen to be used, and moves air in and out of the soil to help the ventilation.

So it is important to have these all present and so arranged that they can work constantly and freely.

How does a soil get worn out? By constant taking away of crops without replacing humus. As the amount of humus lessens the soil holds less water, the surface is washed away more easily, the number of

bacteria are steadily decreased, and less and less humic acids are formed, until finally the forces which turned the rocks into soluble plant food, are no longer able to work, and the almost pure, fine ground rock lies barren or with a few stunted, wild plants, with no visible line between top soil and subsoil. There is no more dark top soil — no covering plants, with their leaves and roots to protect against wind and flood, and the winds and waters that before meant life and plenty, now bring desolation and barrenness.

If man stops such mismanagement, and merely leaves the earth alone, Nature's forces will at once set to work to bring back fertility. The winds and the birds bring seeds, which will grow and die, and the dead plants stay there. The earthworms cover them, the oxygen works on them, the water soaks into them and stays as long as it can. They turn dark and break into pieces, the worms swallow them with tiny pieces of rock and mix them thoroughly, and then pass the mixture out again. Some bacteria find this a good home and set to work. The next seed that sprouts there finds more food ready than the first did, and makes bigger growth before it dies, and so adds more organic material for humus. If man keeps away, animals come. In their lives they drop manure on the land, and when they die, leave their bodies — all to be used for humus. So, season after season, more plants and birds and animals come. But Nature does not need to hurry — only man hurries and worries — and it may take one hundred or one thousand

years to bring the fertility of a worn-out farm back to the point where man found it, *if left to Nature alone.*

Nature, however, shows the kind of things to do to make a fertile soil, and those who look closely and reason, and then act, can furnish the supplies for her laboratory, so as to save time and get larger results.

Nature needs humus in a fertile soil. Bring the material and save generations of time she would take to collect it. Save all the manure, dead leaves, grass and animals.

Nature takes a very long time to make this material into small enough pieces for humus. So break it up for her.

Humus must be decaying and damp. Let us start the decay, and keep the material damp.

This material must be in the soil. Spread it on the ground and plow, or spade, it in.

Nature wants it thoroughly mixed. Cultivate the earth with tools, sometimes deep, and sometimes shallow, several times each year.

Some gardeners and farmers keep a pit into which everything organic that will easily decay, is thrown. Here it is kept wet and slowly changes into good material for humus, and this is then mixed with the soil.

Commercial fertilizers.—There are four elements of plant food which are used up faster than the others, and which some soils do not supply in large enough

quantities to get the results desired in the plants.
These are:

Nitrogen
Potassium

Phosphorus
Calcium

These can be bought and added to the land where needed. They are a great help in bringing mismanaged land back into fertility. But we can waste money and destroy the soil's power to furnish plant food, if we neglect to have plenty of humus, air and water, suitably mixed with the fine rock.

Some of the commercial fertilizers which supply these elements are:

Nitrogen:— Nitrate of soda.
Sulfate of ammonia.
Refuse from slaughter houses.
Prepared sheep manure.

Potassium:— Sulfate and muriate of potassium.

Phosphorus:— Phosphate rock, raw and treated
with acid.
Ground bone.

Calcium:— In the above, and in lime, and oyster shells.

Greenhouse men generally use fine ground bone meal and sheep manure.

Reference books for older children who want to be commercial growers:

Soils,	Prof. F. H. King.
Irrigation and Drainage,	Prof. F. H. King.
Physics of Agriculture,	Prof. F. H. King.
Principles of Fruit Growing,	L. H. Bailey.
Fertilizers,	Voorhees.

Experiments.—A quantity of garden loam, spread out thin and dried in the house for several days.

1. Use the sieves to sort it, and show the different-sized particles it is made up of.

2. Scales—two flowerpots of equal weight—dry garden loam.

Put the same weight of dry soil in each pot. Leave one pot dry. Stand the other pot in a measured quantity of water. Note the capillary rise of water through the pot and soil. When the surface of the soil is thoroughly damp, weigh the wet pot and note how much *weight* of water it has taken up. Measure the remaining water and note what *bulk* of water it has taken up.

Sandy loam will take up water, in bulk equal to 2-3 of itself—in weight equal to 1-3 of itself.

If the experiment is made with soil from the Children's Garden, it will furnish a good problem in arithmetic, to find out how much water their garden needs to wet the soil to different depths.

For instance, if they find their soil takes up $\frac{1}{2}$ its own bulk of water, every surface square foot to one foot deep will need six inches depth of water.

The gardener must plan to obtain this water, either from rain or irrigation.

3. Puddling.— Experiment to teach the danger of working wet soil: Take three flowerpots full of dry soil. Stand two in a basin of water until thoroughly wet. Do not touch the soil in one, but empty one of them into a basin, and with a stick or the hand, mix it thoroughly for several minutes, and then replace in the flowerpot. Set them aside to dry for a few days. When quite dry, take the earth out of the pots, and note how much harder and lumpier is the soil that was worked wet. Put the dry soil of the third pot in a basin, and thoroughly mix and replace. It will be found that working a dry soil does not make it stick together, as it does a wet soil.

4. To save water in the soil — Mulches.— Take three wooden boxes, exactly alike. Put the same weight of dry soil in each. Wet the soil of each thoroughly with the same quantity of water.

They should each weigh the same, after they have stood twenty-four hours.

Cultivate the top of one box for a depth of two inches, and repeat every day, keeping the top two inches loose and fine and dry.

Press the top of another box firmly each day.

Let the third one remain untouched.

Every twenty-four hours weigh the boxes, and keep a record of the weights.

The loss of water will be faster, if exposed to

drafts. The results will show *a* the effect of cultivation for a dust-mulch to retain moisture, *b* the effect of pressure to bring up moisture, and *c* the effect of no cultivation.

CHAPTER XXV

EARTHWORMS

The common earthworm (also called angleworm, fishworm, and by most boys, the big worms called night-walkers) is of much more importance to the gardener and the farmer, than to the fisherman.

When a child has a simple, clear idea of how the earthworm is beneficial, he will have a very good idea of how nature makes a garden soil. The common earthworm is a tremendous factor in making and keeping up a good agricultural soil. Its life history is very interesting. It is very common. Therefore, being common, useful to man, and interesting in itself, it forms a very desirable kind of subject to emphasize in the education of a child, especially the child educated in the garden. The references given in Chapter XXXI will supply the teacher with facts from the observation of others, and they may, with very little difficulty, give much information from direct observation of their own.

A plain wooden box sufficiently strong to hold wet earth for several weeks, filled nearly full with garden earth, with about an inch of small white pebbles on top (such pebbles as are used on tarred roofs), and on these, about a pint of earthworms. Pour a little

water over them, and afterward keep the earth damp. By having more worms to a given quantity of earth than would be found under ordinary conditions, the work they do is emphasized. It is well, in experiments, to make the results a little more apparent, because the untrained observer does not see them well, unless they are emphasized.

The white pebbles on top are to show how earthworms bury stones with the earth they bring to the surface. A few weeks will suffice to nearly cover half an inch of pebbles, if there are as many worms in the box as can be well kept alive. Suitable food, like grass, leaves, manure, meat, onion or cabbage, can be placed in very small pieces on the surface, and the worms will come out at night, and carry this food down into the earth to be eaten at their convenience.

All this is possible in the ordinary class-room, so that when the children go into the garden in the spring, they will be prepared to watch with more interest the earthworms that they turn up in their spading. In May and June, and sometimes again in the fall, earthworm eggs may be found in the soil, and with a little care, the eggs may be hatched under the observation of the children.

Earthworms are omnivorous and cannibals, that is, they eat everything they come to, within their capacity, and are especially fond of earth, manure and other decaying materials, and in eating all of these things, they thoroughly mix them in their bodies. The greater part of what they eat passes on through

their bodies, and is deposited at or near the surface in the familiar worm casts.

In making their burrows, they eat a great deal of earth, and of course, they cannot swallow any stones larger than their mouths, so that all the earth that is brought to the surface by worms has been passed through a wonderful active sieve, which has brought the fine earth, thoroughly mixed with organic matter, up to the surface.

Probably many of the seeds dropped by wild plants are covered by earthworms in this way, and with just about the right amount of earth. The many holes and burrows, which they leave in the ground, are a great help in ventilating the soil, and their most active work is in the soil near the surface, where most of the plant roots will feed. If we study their habits, and what they accomplish, we may be able to improve our methods. In fact, one important thing which they teach us, is to have all of the manure or leaves or fertilizer ground up as fine as we can before mixing it with the soil, and then to mix it very thoroughly.

At the close of the earthworm study, the earth can be allowed to dry for about two weeks, the box upset and contents taken out whole, like taking a cake out of the pan. The worm burrows at the bottom can then be seen. Place a board over the top before upsetting, to keep from breaking up earth.

CHAPTER XXVI

ELEMENTARY FORESTRY

Experiment to show the effect of heavy rain on forest hillsides, as compared with bare hillsides.—
Select a sharply sloping piece of land of any desired



Photo by the Author

The Author's plan for teaching elementary forestry in DeWitt Clinton Park

area. Divide into two equal areas, having as nearly as possible, the same grade of slope. On the portion to represent the forest land, spade the ground, and mix thoroughly with nearly an equal portion of lawn mowings, chopped straw, fine manure, dead leaves,

spagnum moss or some similar absorptive organic matter. This is to imitate the condition of a forest soil, filled with roots and with considerable humus. Plant in this soil some quick-growing seed, to take the place of trees on a miniature scale. Buckwheat is excellent, because of its rapid growth.

When the seeds are planted, cover the surface of the soil over them, with about one inch of such material as was mixed with the soil, for the purpose of making a mulch, to imitate the forest floor covering of leaves. Water thoroughly.

On the ground to represent the bare hillside, remove all surface vegetation, walk on the ground to pack the surface firm, and leave it exposed constantly to the sun. At the foot of each slope, place a board to catch such material as may be washed from the surface above, so that it may be examined.

When the buckwheat has reached a height of about eighteen inches, the experiment may be tried as follows: With a garden hose, imitate a heavy shower, by spraying in such a way that the amount of water which falls shall be equal upon both the bare and forest land. Both may be wet at once, or if desirable, turn the water first on the bare land, until the amount that falls has formed little rivulets that run down hill, and begin to wash the surface. Continue this until considerable washing has taken place.

Time this by the watch, and immediately turn the same amount of water in the same way on the land which imitates the forest, and for the same length of

time. Note the results, and see whether the growth on the surface, the mulch, and the material mixed with the soil has caught and held the water sufficiently to prevent washing. Then note the condition of the



Photo by the Author

The pile of earth was about a wheelbarrowful,—the finest surface soil. It was washed down in a couple of hours' heavy rain, from the eight-foot square plot. The adjoining plot of the same size, but covered with a miniature forest of buckwheat and sunflowers, showed *no soil washing*

bare land, the furrows made by the water running down hill, the material that has been carried from the surface to the trap at the bottom.

You will find that what has been carried the farthest, is the fine soil, the most valuable to the farmer, and

that the remaining surface above has been left bare and stony, and in a condition much more difficult for vegetation to start again.

With forests maintained, and cutting and replanting of trees regulated, there will be a constant water supply for transportation, power, fish, agriculture and the use of cities, a more equable climate (less extremes of heat and cold), a constant timber supply, and a profitable use of land that cannot be tilled (that is, mountainous or rocky land).

Without forests maintained, large tracts of land will be idle, there will be a scarcity of timber, avalanches and landslides, which destroy property and lives, a loss of surface soil from arable hillsides, a loss of navigation in rivers from lack of water, and channels filled with silt, dry wells and springs. Water power for mills will disappear, as well as game, birds and fish. It will be colder in winter, and hotter in summer, and population will decrease.

How forests prevent floods by holding water, and giving it gradually and steadily throughout the year.—When it rains on the trees, every branch and leaf breaks the rapid fall, bringing the drops gently to the ground. The surface earth covered with moss and leaves, soaks it up and gives it time to sink into the subsoil, which is filled with roots. The shade of the trees above keeps the ground from baking hard, and the water can more easily enter. Every tree forms a temporary reservoir, holding every rain that falls there.

Snows of winter pile up in the woods, and protected by the trees, melt very slowly in the spring. At the foot of the trees, the roots near the surface ridge the ground, forming shallow basins which, in the aggregate, will retain for short periods vast quantities of water.

All of this soaking up and holding back of rain water by the forests is of direct and immediate benefit to mankind. It means plenty of lumber for the arts and trades; it means never-failing springs and constant rivers; it means beautiful lakes, filled with fish; it means water power for machinery; it means abundant water supply for great cities; it means valuable recreation grounds for the tired and sick; it means game; it means a cooler climate in summer.

On bare hillsides without trees.—A sudden heavy rainfall pours down with no intervening leaves and branches to slacken it, as it approaches the earth. The surface ground is baked hard and dry without the protection of leaves or moss, often without even grass, and frequently burned over, and before rain can begin to soak in, a thousand tiny rivulets merge in streams, which come together in a raging torrent, which sweeps earth and boulders before it, and tears a gash in the hillside. In a few hours it has passed, leaving a great scar, and the earth is dry again.

On many hillsides this happens again and again every season, and some great river which carries these torrents to the ocean is always muddy. *What makes it muddy?* The most valuable asset of the farmer,

that very fine top soil which he gives so much time, thought, money and hard labor to acquire, constantly and rapidly being carried by these surface washings to the bottomless pit of the great ocean, from which he can never recover it. A year or two of such washings will take from him forever the accumulations of the intelligent labor of generations. Ten years of such washings will make the whole countryside unprofitable, uninhabitable, and desolate.

Foresters and writers on agriculture and kindred subjects have preached such information, almost since the beginning of written history, and yet so difficult a thing to overcome is public ignorance, that the United States to-day is experiencing to a great degree, most of the evils and privations resulting from an ignorant, or else a criminal destruction of its forest areas.

The primary education leaves out of its curriculum, definite instruction about these things, and the system of Government raises to high office and authority, men who have not been taught to think wisely or well about great economic sources of wealth and prosperity.

If the people who elect the legislators for the United States, for each state, for each city, and those officers who are called upon to enforce regulations, had been trained in a system of public education, which had properly presented to them, as children, in a simple, convincing manner, some vital facts and principles regarding such matters as the Forest Prob-

lem, the present state of affairs could never have come into existence.

No one is to blame, because too many are at fault. Nevertheless, two hundred and fifty years ago, a clear writer and a great educator, John Amos Comenius, gave excellent advice on education, which had it been followed, we would have avoided much poverty, sickness, distress, and inefficiency both as individuals, and as a nation. Under the head of conciseness and rapidity in teaching, he says: . . . "We ought to exclude from our schools, all books that merely teach words, and do not at the same time lead to a knowledge of useful objects. We must bestow our labor on that which is of real importance, and therefore, must devote ourselves to the improvement of our understanding, rather than to the enlargement of our vocabulary. Any reading that is necessary, can be got quickly out of school hours without tedious explanations, or attempts at imitation; since the time thus spent could be better employed in the study of nature." In another place, he says: "For instance, they (the children) may be given tools and allowed to imitate the different handicrafts, by playing at farming. . . ."

CHAPTER XXVII

CO-OPERATION

From the initial step of a Children's Garden, its value and effectiveness depends much upon the co-operation aroused in its interest. The parents of the children, the neighbors, the big brothers and sisters, the uncles, aunts and cousins, and all visitors must be drawn into the atmosphere of contagious good will.

They should have reasonable freedom to visit and watch the work, and have a feeling of sharing in its prosperity. There are many ways that all can help and benefit by it. The desire to help is strong in human nature, and by securing it, we disarm hostility.

The man who sends a load of manure, or lends a spade, will come in to see how things are progressing. The loafers who come seeking mischief, and who can be annoying, will be completely disarmed after they have been diplomatically allowed to help with the work. They will seldom do much, but this little breaks the ice, and makes them helpful and willing to protect the garden, if only by keeping away.

Co-operative service is a potent means of developing good will, and because the garden does this, it becomes important in developing civics. The garden

will become a clearing house for kindly actions and interesting information. A visiting gardener will offer suggestions and carry away an idea. Cooks will tell you new ways of preparing vegetables. All sorts and conditions of men will take a few minutes at noon or night, to walk by the garden and see the interesting observation plots. Broom corn and peanuts are common enough as brooms, or on the vendor's stand, but amazing growing in a plot, and when the garden wants a box, or sawdust, or tin cans, or some other simple thing, these men can tell where to get them, and will often bring them to you.

There is no citizen so humble, but what his interest and good will are desirable, and no man in a community is so powerful, that the welfare of the children is not of importance to him.

In the country schools, it will bring the farmers and their wives in closer touch with the young teacher, who is striving to help their children. She has been trained to teach, but they have much practical knowledge gained in the school of life which they can bring to her aid, for the children's sake, and they can bring assistance in preparing the ground, fence materials, seeds and when to plant them, the loan of tools, how to use the product, and the moral support of earnest good wishes.

In the city gardens, friendly fire departments help with the watering, and departments of parks, health, and street cleaning, have many resources available to those who seek them for the good of the children.

CHAPTER XXVIII

HOUSEHOLD INDUSTRIES

In a Children's Garden carried on during the vacation months, household industries will round out



Children's School Farm, Jamestown Exposition, 1907. Installed and directed by the Author

its pleasure and usefulness. The boys and girls delight in playing house.

There should be a skillful housekeeper in charge — one able to work with the simplest outfit, and who radiates good will and efficiency. Home consists in the spirit of the home makers, rather than the inanimate

house and furnishings. Cordial hospitality and good manners will beautify the simplest home.

The house should be small and attractive, with a wide porch, and at least two rooms — kitchen and living room — with good windows. All the fittings should be low-priced and serviceable. Here different groups



"This is the Children's Farm House"

of small gardeners can take possession each day, and go through all the operations of housekeeping; sweeping, dusting, washing windows, scrubbing floors, washing, ironing, sewing, cooking, serving little meals to each other, and receiving guests.

Here the instructor can show them the various ways to use their garden crops, and serve them attractively, and all the little ways of lightening household labor. When the right spirit is infused, the honor of being a housekeeper will be eagerly sought.



The wide porch



The kitchen



The living room



Cleaning house



Washing clothes



Ironing



Three cooks



Photos by the Author

Vegetables fit for any cook



Housekeepers at tea



Spring cleaning



Photo by Brown Bros.
Crippled children entering the Garden. DeWitt Clinton Park

CHAPTER XXIX

SPECIAL GARDENS

Children's Gardens for anemic, crippled, tuberculous and convalescent children.— The children's health will gain through rest, short periods of gentle exercise and happiness, while in the fresh air and sunshine.

Give special attention to having the work light and well within their strength, and never continued long. Frequent periods of rest, where they will be quite comfortable sitting, or preferably lying down. In cool weather, well wrapped up. In spring and fall, the feet protected against wetting, and in summer, the head and eyes protected against sun. The garden is filled with delights for such children.

For this class of children, the ordinary playground

is prohibitive, because of its activity and the child's weakness. It cannot meet their needs as the garden does, nor the needs of another class of children, viz.:

Backward and deficient children.—In guiding these children, the emphasis in the work is placed on the



Photo by the Author

Bird's-eye view. Children's Garden for tuberculous children at Bellevue Hospital, New York City. Installed and directed by the author in 1909

doing and making, the manual side. It stimulates them mentally, and the objectiveness of it all places it within their mental grasp. In addition to this, what they do learn, is knowledge they can use. Of course, in common with all children, their progress is im-

proved, hastened and made more lasting by happiness, fresh air and sunshine and good food.

The winter garden.—The space allotted to the Children's Garden in summer can be well used throughout the winter, by such means as Mrs. Henry Parsons



Photo by the Author

Nearer view of the Children's Garden, Bellevue Hospital, 1909

has shown in the Children's School Farm in DeWitt Clinton Park, New York City, during the winter of 1909 and 1910.

A platform laid just a few inches above the ground to avoid dampness. On the north side, a wooden fence nine feet high, with a hood at the top to turn

the north wind up, away from persons on the platform. The fence on the east and west ends, part solid, part curtained. Decorated with evergreens in boxes. The whole, boxes, floor and fences, made in sections convenient to put in place and remove.



Photo by the Author

Children gaining vitality from fresh air and sunshine. Winter garden. DeWitt Clinton Park, 1910. Planned by Mrs. Henry Parsons

Thermometers hung on opposite sides of the north fence registered a difference of 30 degrees Fahrenheit. The equipment consisted of steamer chairs, large army and horse blankets, pillows covered with turkey red, and foot warmers.

The foot warmers were made of the hand carriers

of the garden, lined with thick asbestos, and containing hot bricks.

The whole arrangement was designed to exclude the wind, and concentrate the sunshine and blue sky, with a color scheme to rest the eyes and nerves. The evergreens to furnish living plants to relieve the monotony of winter desolation. It proved comfortable and attractive for five hours, on the coldest and windiest day of the winter.



Photo by the Author

Six-year-old boy, with hip disease, getting fresh air and sunshine, in the winter garden. Steady improvement began within forty-eight hours

This winter garden was established for crippled and anemic children, but because of the need of convalescent adults and tired mothers of the neighborhood, the courtesy of its use was soon extended to them also. As a result, the mothers' clubs of the neighborhood held meetings, and served afternoon tea in the winter garden, instead of the overheated clubroom, learning by experience the invigorating effect of outdoor air.

CHAPTER XXX

OTHER GARDENS

Where the garden is connected with a school, it should conform with certain special needs of the curriculum and class hours. In a public park, where the garden is for recreation and health, there may be more freedom in the hours of attendance of the children, which must of necessity be out of school hours, and during vacation. In gardens under private auspices, a charge may be made.

When the number of children is small, more attention can be given to each detail of the work, while in gardens with many children, it may be wise to give more attention to general results and appearance of the whole, even at the sacrifice of some details.

In localities where there can be home gardens, the smaller plots of the school garden are sufficient for purposes of instruction, after which, in their homes, the children can use the knowledge for cultivating larger plots. In other places, the amount of product per child may be of sufficient importance for each to have as large a plot as they can cultivate successfully. There are many home gardens, where the workers undertake just a little too much for their time and strength, and they become discouraged, and

the garden is then neglected, or what is ultimately worse, the children become imbued with a dislike for the work, which colors their after-life.

For adults as well as children, there is real pleasure and recreation to be obtained, when one learns how

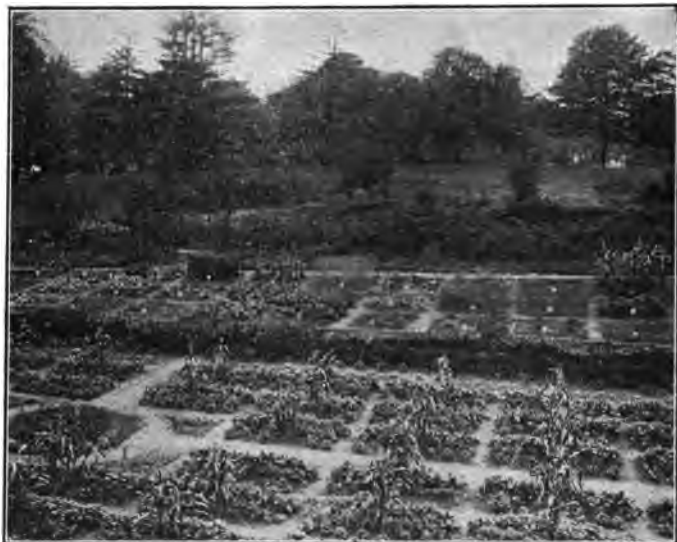


Photo by Golde

Garden of the Department of School Gardens, New York University, under the direction of the Author

to work easily, and limits the amount to be done. All the time should not be spent in grubbing weeds. A goodly portion should be allowed for looking on, while Nature unfolds her flowers, paints the leaves with gorgeous or delicate tints, and fills the air with perfume.

A visit to the garden at sunrise, when the air is

still, will reveal the dew-gemmed plants catching the first rays of the sun, and furnish a sight to well repay the effort of early rising. This is the hour in which



Adults learning to spade at the New York University

to gather sweet peas and nasturtiums, which will hold their freshness and fragrance for hours longer than if picked at midday.



Photos by the Author

Adults learning to plant at New York University

Turn to the garden for delight and inspiration for the mind and soul and at the same time, with cheerful



Adults learning to judge vegetables and prepare them for exhibition and for the table, at New York University

shrewdness, get it to supply the inner man with succulent and dainty dishes.



Photos by the Author

A meal of vegetables, grown, prepared, and cooked in the garden, and eaten under the grapes at the New York University

There are places where the delights of a Children's Garden should not be restricted to those under fifteen, for the spirit of a child often inhabits the body of the adult, and the little plot will give them just the opportunity to play at gardening, and satisfy their longing with the short time, or perhaps little strength, they can spare for it. There are busy men and women in factories and shops, who would love to be one of the children for a few minutes once or twice a week, and men and women whose age or feeble health has pushed them from the ranks of wage earners, would find here the gentle activity and interest to keep them contented.

For all people, into whatever paths their lives may lead, the going will be more worth while, their outlook upon life brighter, and their own powers enlarged from the experience and knowledge of beauty and usefulness gained in the garden. ✱

CHAPTER XXXI

BOOKS FOR THE TEACHER

In many books there is much confusion. The United States Department of Agriculture furnishes excellent information on many subjects, bulletins of which can be obtained direct, or through Congressmen. The Year Books are especially good, and some references are made to show how valuable they are.

The following are also helpful:

Practical Garden Book,	Hunn & Bailey.
Principles of Vegetable Gardening,	Bailey.
The Soil,	King.
Experiments with Plants,	Osterhout.
Cornell Nature Study Leaflets	N. Y. State
and similar leaflets from	Dept. of Agriculture.
other states.	
Earthworms & Vegetable Mold,	Darwin.

The following Year Books should be in every school that has a garden. The information furnished, and the way it is presented, is not excelled, and is of especial value to the Children's Garden.

References to the Year Books of Department of Agriculture, Washington, D. C.

YEAR	TITLE	PAGE
1908	Economic Value of Predaceous Birds and Mammals	187
	The Wastes of the Farm	195
	Causes of Southern Rural Conditions and the Small Farm as an Important Remedy	311
	The Relations Between Birds and Insects .	343
1907	Does it Pay the Farmer to Protect Birds? .	165
	The Value of Insect Parasitism to the American Farmer	237
	The Weather Bureau and the Public Schools	267
1906	Object Lesson Roads	137
1905	The Use of Illustrative Material in Teach- ing Agriculture in Rural Schools	257
	Formaldehyde: Its Composition and Uses	477
1904	Practical Road Building	323
	Some Uses of the Grapevine and Its Fruit	363
	Consumers' Fancies	417
	Boys' Agricultural Clubs	498

UNITED STATES DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETINS.

BULLETIN

- No. 28 Weeds and How to Kill Them.
54 Some Common Birds and Their Relation
to Agriculture.

BULLETIN

- No. 86 Thirty Poisonous Plants of the United States.
- 134 Tree Planting on Rural School Grounds.
- 154 Home Fruit Garden. Preparation and Care.
- 155 How Insects Affect Health in Rural Districts.
- 188 Weeds Used in Medicines.
- 192 Barnyard Manure.
- 195 Annual Flowering Plants.
- 218 The School Garden.
- 255 The Home Vegetable Garden.
- 256 Preparation of Vegetables for the Table.

BUREAU OF ENTOMOLOGY.

CIRCULAR

- No. 2, 20 & 81 Plant Lice.
- 60 The Imported Cabbage Worm.
- 71 Houseflies.

OFFICE OF EXPERIMENT STATIONS.

BULLETIN

- No. 160 School Gardens.
- 186 Exercises in Elementary Agriculture.
- 204 School Gardening and Nature Study in English Schools.

CIRCULAR

- No. 60 Teaching of Agriculture in the Rural Common Schools.

DIVISION OF BIOLOGICAL SURVEY.

CIRCULAR

- No. 56 Value of Swallows as Insect Destroyers.
61 Hawks and Owls from the Standpoint of
the Farmer.

BUREAU OF FORESTRY.

CIRCULAR

- No. 130 Forestry in the Public Schools
157 A Primer of Conservation.

YEAR BOOK PAPERS.

PAPER

- No. 133 Birds as Weed Destroyers (Reprint, 1898).
194 The Food of Nestling Birds (Reprint,
1900).

APPENDIX A

Costs of tools and equipment.

Rakes (malleable iron), per dozen ..	\$2.50	
Hoes, per dozen	4.20	
Spades, per dozen	6.00 to	12.00
Spading forks, per dozen	6.00	
Watering pots, per dozen	4.50	
Wheelbarrow, each	2.50	
Garden hose ($\frac{3}{4}$ inch), per foot	.10 to	.12
Nozzle, each	.35	
Mosquito netting, per yard	.08 to	.10
Bobbinet, per yard	.25 to	1.00
Heavy garden line, per 100 feet	.50 or	less
Mason line, per pound	.35	
Copy books (for diaries), each	.02 to	.05
Insect pins, per 100	.10	
Poison jar, each.....	.40	
Mounts, Denton, each	.15 up	
Mounts, Riker, each	.19 up	
Mounts (wooden box), each	.90 up	
Atlas special glass jar, each	.08	
Plaster of paris, per pound	.05	
Cyanide of potassium, per ounce	.05	

SCHOOL GARDEN ESTIMATES OF COST.

50 PLOT SCHOOL GARDEN — 1 TEACHER — 10 WEEKS
(JULY, AUGUST, SEPT. 15).

1 teacher at \$2.50 to \$4.00 per day, 60 working days	\$150.	to	\$240.
Seeds and fertilizer for 50 plots, \$.20 to \$.50 each	10.	to	25.
Tools, 10 sets at \$1.50 to \$2.50 each set	15.	to	25.
Sundries	25.	to	35.
Total	<u>\$200.</u>	to	<u>\$325.</u>
First preparation, man labor ..	<u>25.</u>	to	<u>25.</u>
Total	<u>\$225.</u>	to	<u>\$350.</u>
(Land, fences, building not es- timated)			
For six months add salary again	<u>150.</u>	to	<u>240.</u>
Total	<u>\$375.</u>	to	<u>\$590.</u>
100 plot garden would cost 50% more or	\$562.50	to	\$885.

500 PLOT SCHOOL GARDEN — 8 EMPLOYEES — SIX
MONTHS SEASON.

1 head teacher at \$100.—\$150. a mo., 7 mo.	\$700.	to	\$1050.
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CHILDREN'S GARDENS

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1 clerk at \$30.—\$50. a mo., 6 mo.	\$180.	to	\$300.
5 assistant teachers at \$50.—\$75. a mo., 6 mo.	1,500.	to	2,250.
1 laborer and handy man at \$45.—\$60. a mo., 7 mo.	315.	to	420.
100 sets of garden tools at \$1.50.—\$2.50 a set	100.	to	250.
Seeds and fertilizer for 500 plots at \$.20 to \$.40	100	to	200.
First preparation, \$50.—\$100.	50.	to	100.
Sundries	55.	to	130.
	\$3,000.	to	\$4,700.

(Land, fences, building not estimated)

Wire fence 10c to 15c a running foot	} including labor
Good fence 50c to \$1.00 a running foot	
Tool house and shed, \$50.00 to \$2,000.00.	

APPENDIX B

The 1908 report of the Children's School Farm in DeWitt Clinton Park, N. Y. City, is given to show the wide extent of its activities and usefulness, and to illustrate the possibilities for other communities.

The City of New York,

DEPARTMENT OF PARKS,

Boroughs of Manhattan and Richmond,
Report of the Bureau of Children's School Farms for
1908.

No. 1. Location in DeWitt Clinton Park, 52nd-54th
Streets and 11th Avenue.

Area of garden — North and south, 250 feet; east and
west, varying from 120 to 150 feet.

The location, area and general plan of the garden are
the same as in 1907.

Maintenance — Appropriation in the Budget the same
as in 1907 — \$5,000.

THE GARDEN.

REGISTRATION.

The opening of the garden depends, like all other outdoor work, upon the season. As early in the season as possible, and if weather conditions will allow,

the flag is raised, and the children who desire plots flock in eager crowds to register their names for possible land claims. Each year shows a large increase in this desire.

SPADING AND PLANTING.

The systematic method of spading, which has been in practice for several years, has made it possible for the children to do more and more thorough work in preparing the ground. The park laborers, not being able to finish the regrading of the garden in the fall, they completed their work in the spring. Outside of this, the first spading was done by the children, but it was necessary to have the mid-summer spading done by laborers, as the prolonged and intense heat was so debilitating that the children could not cope with the situation. The open weather continued later than usual in the fall, which made it possible for the children to prepare the ground for spring. Their enthusiasm for this part of the work is so great that one hundred children stood in line and waited patiently for an hour, watching eagerly for their more fortunate companions to grow weary, and so leave an unused spade. Deeming this too much of a test of patience, and the hours after school being so short when active work can be done, a sufficient number of spades has been supplied to enable each child to participate in a jolly hour of active, useful work.

When all is prepared for planting, postals are sent out in the usual way, taking the names as they come

on the list, notifying the children to be present on a certain day and hour for planting. The registered name standing in the same relationship as one applying to the park for a permit; the postal card being a notification that the applicant may have the privilege of playing a game of seeds on a given date. The tag, exchanged for the postal card, represents the permit to play this game of seeds, which may last a little longer than a game of tennis or ball, but there is opportunity for many to participate in it during the season.

On the planting days, as each relay of 25 children has been registered, and tags or permits exchanged for the postal cards, under the supervision of the teachers, an object lesson is given, and twenty-five plots are planted with seven varieties of vegetable in each plot. It depends upon the number of children responding promptly to the notice sent out as to how many plots can be planted in a day. This year the garden was very nearly planted in two days, but it takes a week to finish up with the laggards.

If everything is auspicious, the first planting usually takes place early in May, and the first crop is harvested from July 13th to 20th. The plots are respaded and a second set of farmers are registered, and the first process is repeated. During 1908, the same system obtained as in preceding years, of having two crops of vegetables and two crops of children.

The upper part of the pergola building furnishes a sort of gallery for an audience which, while difficult

to handle, is most interesting. Even the children who have never had a plot, and are impatiently waiting for their opportunity, think they know just how the things should be done. Their interest is so great, that they cannot restrain themselves from giving advice when they see some little farmer, new to the work, making a mistake. A stranger might deem this disorder, but it is not intended as such. An additional excitement is caused by those whose names have been omitted, fearing that they will not receive a plot. As soon as all claims have been satisfied and the seeds are actually in the ground, this seeming disorder disappears.

WEATHER CONDITIONS.

During the first planting, the weather was most propitious and everything went very smoothly. The prolonged heated term and drought, which obtained throughout the country, made it necessary for the "Little Farmers" to give extra care in watering and tending to their plants, but this heated term proved more than ever the incalculable benefit — not only to children and babies, but to adults — of such a garden with its cool, shady, vine-covered summer-house (containing hammocks in which the babes could be placed, so relieving the tired arms of the little mothers and fathers) and its awnings and tents, amidst beautiful flower beds, where the weak and suffering child and discouraged mother could find rest and refreshment in the still beauty.

Never has the garden been a greater boon to the neighborhood, than this season. Adults, recovering from prolonged illnesses, felt that here was a spot of beauty to entice them forth into the fresh air.

OBSERVATION PLOTS.

The observation plots, in previous years having proved their value to the older children and adults of the neighborhood, were not only utilized for the same purpose in 1908, but were enlarged upon. The names of the various products of these plots will be found in the appended list.

But one I would like to speak of especially: A 4 x 8 foot plot of flax proved to be a poetic link between the garden and the Irish element of the neighborhood. It was not necessary for the director or teachers to explain the life history of this plant. A ray of joyous light would come into the most discouraged and saddened faces as they recognized this soft green plant with its tiny blue flower, which carried their memories back thousands of miles and many years to the dear old home in Ireland, where they in their youth had planted, grown and prepared this fibre plant which was to evolve into the snowy linen spun and woven in the home. One laborer, who thought he would like to prepare some of it as in the olden times, disappointed at his lack of success, not realizing that his hand had lost its cunning, or perhaps the fascination was one largely of imagination, attributed his failure to the running water of modern

times, not having the virtue of the long ditch filled with still water in that dear old Irish field. The charm of this plot was so evident, its crop was constantly renewed.

Another plot which excited much interest was called the "Shakespeare Plot," as the seeds of the different flowers came from the home of William Shakespeare at Stratford-on-Avon.

In order to give both the children and adults of the neighborhood some idea of the effect of the wasteful destruction of forests upon the country's waterways, a little forestry object lesson was constructed in a simple manner on a 4 x 8 foot plot, and by its side a miniature bare hillside of the same size, the interlacing roots and forest conditions preventing any washout of soil from the one, but allowing deep gulleys and washouts in the other.

Hygiene, both as applied to plants and human beings, was demonstrated by covering plants with tin cans or tiles, thus showing in the simplest manner and carrying home to the children, a lesson as to the effect of lack of sunlight and air, which could be easily applied to their own needs without giving offense.

FLOWER BEDS.

The seven years' existence of the Children's School Farm in DeWitt Clinton Park, has proved that such a garden properly conducted, while having its individual plots for the children, can be of great benefit

and pleasure to adults as well by including in the garden the usual park features of decorative flower beds, composed of propagated plants from the park's greenhouses — all may enjoy them, but still learn the private care of public property. Sometimes these plants can be set out by the teachers and children, but sometimes it is necessary to have the gardeners do this work.

The same applies to bulbs, set in the fall. They are a park feature, but included in the Children's Garden.

PERSONNEL OF CHILDREN.

The personnel of the children using this garden in 1908 has become so diversified that it is worthy of note.

The number of crippled children of 1907 increased from 50 to 150 in 1908, brought, as before, by the Crippled Children's Driving Fund, twice a week. The plots on either side of the center path, from north to south, were given over to these children — the wide center path allowing of more space for the accommodation of their crutches and braces. If this garden had been provided for this purpose and no other, it would have been vastly worth while. The long straight paths, between rows of vegetables, seem to give the crippled children a feeling of safety, and little by little they gain courage to become more active. One little fellow of seven years of age, with only one leg, his crutch fastened through a loop in his trousers, seemed to cover the distance from gate to summer-house in three jumps. He almost flew. I met him

one day with a watering-can full of water in each hand, joyously happy in the thought of caring for his plot. The look of happiness and the momentary forgetfulness of pain in the faces of these children, whose days and nights are filled with suffering, is intensely pathetic. The street and ordinary playground are prohibitive, because of the child's handicap by physical deformity and weakness, but in this child's world of beauty and delight, they can rest or work as they desire. Their ages range from 3 to 20 years. Of the latter age, one boy — who had been paralyzed for years — was carried to a bench placed by the side of a plot assigned to him; he could only feel the leaves with one hand, and the well children did the work for him, but the joy and happiness in watching these living green things, which he felt were his, gave something to his spirit that was far beyond the effect of any medicine. These little sufferers not only carry away large armfuls of vegetables and flowers, but a mental picture which mitigates the long hours of suffering in their unattractive homes.

The garden has grown also in its usefulness to the classes in biology and botany in the schools, who have accepted, as never before, the courtesy extended. 600 boys from the DeWitt Clinton High School, in classes varying from 45 to 200, made use of the garden three times a week, finding for themselves the answers to their botanical questions in the living green things in the garden.

The graduating class of girls from the Washington

Irving High School, felt that they could learn more biology and botany from a 4 x 8 foot plot in the open, than by studying charts on the walls in the classroom for years.

Kindergartens, first primary classes, grammar school boys and girls and high school graduates, numbering in the thousands, used the garden without interfering with the regular little farmers.

A picture of one morning will perhaps serve to illustrate the garden's usefulness. As I entered the northerly gate, 84 high school boys, with typewritten lists of questions made out by their teachers, were wandering through the northerly end of the garden in search of answers; 104 grammar school girls were at the southerly end; a mother with her twin babes, three weeks old, and a little three-year-old girl, playing at her side, sat in the summer-house gaining strength and health. It is just after the birth of an infant that the poorly nourished mother has the strongest tendency towards tuberculosis. An unusually large number of parents have applied for plots for their children this year, explaining their difficulty as to what to do with their delicate children, whom they cannot send or take to the country.

The garden, this summer, was also a boon to young working girls, who have but a two weeks' vacation, and no way of leaving the city. In some cases this summer, some girls would have become fatally ill, could they have not come to this garden while waiting for an opportunity to go to Sea Breeze.

For the first time a kindergarten class of colored children, numbering 40, was assigned a plot, each baby putting in one seed. They made a unique picture standing about a plot singing their little song of the watering-can, while real water came out of a real can. One small boy, age four, was so taken with the flag floating over the summer-house, that we furnished each with a flag, and they gave us their kindergarten flag drill, feeling very much like little soldiers.

The courtesy of this garden is extended to the schools in the same manner as the American Museum of Natural History, Metropolitan Museum of Art and botanical gardens extend the courtesy of the use of their grounds and buildings. While adults are not allowed to touch the children's plots, which must be considered exclusively their own, they are welcomed as visitors at all times that the garden is open. On election day, the parents took advantage of the holiday to view their children's plots, and enjoyed the vegetables prepared in the household industries, which were served with great delight by the little housekeepers, being the products of their own labor.

The garden has grown in such favor that applications have come from all over the city from schools and children for plots.

CROPS.

The crops were about the same as in former years, except that the fall was propitious toward fuller maturing than usual.

Samples of some of the products were exhibited at the American Institute, which is the New York County Fair, and a diploma awarded for same.

VISITS OF OLD FARMERS.

One of the most interesting features of the season's experience, has been the visits of the old farmers, many of whom have married, but with one accord, they all proclaim the seasons spent in the garden were the happiest of their lives.

AWARDING OF FLAG.

As a reward of merit for the neatest section, a flag is awarded by a committee of children, who are very much impressed with the importance of their position as judges. For the first time in seven years, the boys' section won the flag. Excitement ran high.

CIVIC TRAINING.

The individual ownership of a plot does not mean the exclusion of other children. Their friends of all ages are always welcome to visit the wonders of this garden.

One of the strongest reasons the director had in starting this garden, was to teach the private care of public property. This must be done through education. By having the children lay a strip of sod about the flower beds, and making of a grass-plot a miniature lawn, and being expected to take care of this, and keep it in such condition that it will not mar the

beauty of the garden, they gradually learn, as in no other way, why the lawns outside the garden, maintained by the city, must be taken care of and protected. The ownership of an individual plot, and confining that owner's care to that one plot, in a short time develops selfishness in the children. This is overcome by requiring from each and all a general care of the whole garden, such as paths, decorative flower beds and grass, so uniting individual ownership with a responsibility for the appearance of the whole, making a foundation for good citizenship.

Effort is made in the garden to impress upon the children, that this garden is the children's world, its beauty, order and success is dependent upon them, but that outside of the garden fence belongs to the adult world, and deference and respect must be paid to their rights.

The beneficial results from these lessons cannot be hoped for in a day, but the seven years of the garden's existence, have proved that the neighborhood has been influenced by them. Individual ownership must be the keynote for all such instruction.

The fish episode: In July, between the harvesting and planting of the second crop, a large school of fish appeared in the North River, which caused the banks of the Hudson to be lined with men, women and children vying with each other to catch the longest string. But where was the cave-dweller of New York to find the delectable angleworm? Many applications were made by the larger boys for permission

to dig in the garden and find worms. This permission was granted on one condition, and that was, as soon as the second crop was planted, the garden was not to be molested. As long as an unplanted space remained, this permission was still granted, but from the day that the last seed was planted, not a case of intrusion occurred. What greater evidence could be produced as to the respect in which this garden is held? Three-quarters of an acre of ground within 300 feet of the river, and not a hole dug, after permission was withdrawn.

At the great International Tuberculosis Exhibit in Washington, a special award of a gold medal was made to the exhibit of work done in this Children's School Farm, DeWitt Clinton Park, shown in pictures and model, and with one accord, the six thousand delegates from all over the world claimed that the children's school farm was the solution of one of their greatest problems as to what to do with the child with a tendency towards tuberculosis, or for those in whom the disease has been arrested or cured.

Eminent physicians claim that the hours spent in such a garden would strengthen delicate children enough to enable them to offset the unwholesome environment of the home where they must live.

A picture of the happy joyous children digging, spading, raking, hoeing, planting, watering, after five hours of confinement in the schoolroom is convincing proof of what such a garden does toward straightening of round shoulders, encouraging of deep breath-

ing, and the developing of normal, healthy bodies.

There is no longer a question of the value of this work both for moral and physical tuberculosis. The world has put its seal of approval upon it.

FIRST CROP, 1908.

Yield of 432 plots, first half of season

	TOTAL	AVERAGE PER PLOT
Radishes	43,200	100
Beans	216 qts.	$\frac{1}{2}$ qt.
Beets	8,640	20
Carrots	8,640	20
Onions	8,640	20
Lettuce	4,320	10
Corn	Distributed as Nature material.	

First set of children began planting May 4th.
Crops were harvested from July 13th-20th.
Plots were respaded during harvesting of first crop
and planting of second.

SECOND CROP, 1908.

Yield of 436 plots, second half of season:

	TOTAL	AVERAGE PER PLOT
Radishes	65,400	150
Beans	436 qts.	1 qt.
Beets	10,900	25

	TOTAL	AVERAGE PER PLOT
Beet tops	436 pecks	1 pk.
Carrots	13,080	30
Lettuce	4,360	10
Onions	8,720	20
Corn	872	2 ears

Second set of children planted from .. July 21st-29th.
Crops were harvested and plots spaded from Nov. 9th-
Dec. 1st.

NUMBER OF CHILDREN HAVING INDIVIDUAL PLOTS.

First half:

Boys	386
Girls	325

COMMUNITY PLOTS.

6 plots assigned to classes:

Children using same	283
Total	994
Transfers for various reasons	279

Second half:

Boys	363
Girls	380
Total	743
Transfers	307

CHILDREN'S GARDENS

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WHOLE SEASON, 1908

Yield of 432 plots, first half of season:

436 plots, second half of season:

	TOTAL	
Radishes	108,600	
Beets	19,540	
Beet tops	436	pks.
Beans	652	qts.
Carrots	21,720	
Onions	17,360	
Lettuce	8,680	
Corn	872	ears.
Number of boys	749	
Number of girls	705	
Community plots	283	
Total	1737	
The daily attendance averaged	50%	

TOTAL OF PEOPLE DERIVING PROFIT, PLEASURE AND HEALTH BY CONTACT WITH THE GARDEN.

Number of plot owners, first half of season	994
(283 of this number had community plots)	
Number of plot owners, second half of season ..	743
Visiting children from schools	2442
Registered visitors	765
(Exclusive of adults of the neighborhood) and baby brothers and sisters of "Little Farmers."	
Total	4944

AREA COVERED BY GARDEN. USEFULNESS.

Nature material distributed. To schools in borough of Brooklyn, and as far uptown as 119th Street and 2nd Ave., N. Y. City.

Visitors: Come from all parts of the world.

Active farmers: Cover an area of from 28th St. to 66th St., from 6th to 12th Aves.

Crippled children are brought from: East 12th to East 88th St. West 35th St. to West 68th St. Ave. A to West End Ave.

COUNTRIES, STATES AND CITIES REPRESENTED BY VISITORS.

Countries	6
States	32
Cities and towns	108

NATURE MATERIAL SUPPLIES TO THE FOLLOWING
SCHOOLS.

Borough of Manhattan:

- Vacation school #3, Hudson & Grove Sts.
20, Rivington, Forsyth & Eldridge Sts.
58, 317 W. 52nd St.
62, Hester, Essex and Norfolk Sts.
158, Ave. A bet. 77-78th Sts.
159, 119-120th Sts.—2nd Ave.
172, 108-109 Sts.—2nd Ave.
177, Market and Monroe Sts.

- Public school #17, 335 West 47th St.
28, 257 West 40th St.
69, 125 West 54th St.
141, 462 West 58th St.

Nursery and Child's Hospital.

Dr. Browning's private school for boys.

Amity Kindergarten.

DeWitt Clinton High School.

Lex. Ave. School for deaf and dumb.

Borough of Brooklyn:

- Vacation school #8, Hicks, Middagh and Poplar Sts.
6, Warren St., near Smith.

Vacation school #147, Bushwick Ave., Siegel and
McKibben Sts.

150, Christopher Ave., Sack-
man St.

(21 schools supplied in all)

THE FOLLOWING VEGETABLES, FLOWERS, WEEDS, ETC.,
WERE MADE FAMILIAR TO THE "LITTLE FARMERS."

- 25 varieties of vegetables.
- 40 varieties of flowers and plants.
- 15 common weeds.
- 4 varieties of fruit.
- 4 varieties of grain.
- 7 farm grasses
- 3 fibers.
- 2 nuts.
- 8 birds.
- 30 insects.

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DECORATIVE FLOWER BEDS.

Propagated plants set
out:

Castor plant, geranium,
alternanthera, canna, co-
leus, English ivy, sal-
via, dusty miller, be-
gonia, lantana, albutum,
gazania, amaranthus,
lobelia, centaurea,
pansy, musa, vinca
major.

Seeds planted :	Cosmos, coreopsis, dahlias (roots), marigold, portulaca, morning-glory, balsam, cockscomb, calendula, zinnia, scabiosa, verbenas, nasturtium, four o'clocks, iris, sweet peas, sun flower, sweet alyssum, celosia, castor plant, candytuft.
-----------------	---

(TULIP AND HYACINTH BULBS SET OUT FOR SPRING.)

19 varieties of park plants and 21 varieties	
of seeds planted	40
Number of propagated plants set out	2832
Flower space in garden	2586 sq. ft.

OBSERVATION PLOTS.

Cabbage, cauliflower, brussels sprouts, kohlrabi, kale, sugar beet, chufas (Spanish), clover, tomato, turnip, millet, broomcorn, wheat, hemp, barley, oats, strawberries, muskmelon, watermelon, Swiss chard, potato, pepper, peanut, flax, parsnip, salsify, cotton, squash, okra, buckwheat, rye, dwarf and field peas, alfalfa, celery, eggplant.

Shakespeare plot contained poppy, mignonette, pansy, nasturtium.

Elementary forestry experiment.

Hygiene experiment.

Banana plant.

WEED PLOT.

Cockle, smartweed, ragweed, pigweed, wild oxalis, camomile, purslane, spiderwort, galinsoga, sorrel, wild strawberry, dock, mallow, jimson weed.

CHILDREN'S PLOT.

Radishes, beans, beets (Egyptian and Detroit), carrots (Early Forcing and Danvers), lettuce, onions and corn.

MIGRATORY BIRDS (NORTH AND SOUTH).

Wood thrush, robin, meadow lark, junco, goldfinch, woodpecker, warblers (3 varieties), sparrows (English, song, chipping).

INSECTS FOUND IN GARDEN.

Swallowtail butterfly, monarch butterfly, promethia moth, cabbage butterfly (life history), cecropia emperor moth, Colorado beetle, striped cucumber beetle, grasshopper, black crickets, aphids, tomato worm, ladybird or bug (life history good), ladybird or bug (bad), earthworm, golden-eyed, lace-winged fly, dragon flies, measuring worm, wireworm, mosquitoes, cutworm, house fly, hover fly, hornets and wasps, bumblebees and honey bees, ant, garden spiders, army worm moth.

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